THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXVII. No. 660.] LONDON, JANUARY 4, 1876. [28th Year.] Price

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1808. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. Ramsay, Newcastle-on-Tyne.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT
(Mixed ready for use).
These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
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(Successors to Samuel Calley. Established 20 Years.)
21, GT. WINCHESTER ST., LONDON.
Works: BRIXHAM, TORBAY.

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MANUFACTURER OF
WOOD GRIDS
FOR
PURIFIERS
AND
SCRUBBERS.
BROOKFIELD IRON-WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
Quay Side, Newcastle-on-Tyne.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL AND CO.,
THE WEDNESBURY TUBE-WORKS, WEDNESBURY;
AND
THE ALMA WORKS, WALSALL.
Established at the commencement of Gas Lighting.
Warehouses:
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COMMERCIAL STREET, SPITALFIELDS;
5, CHARLES STREET, SOHO; and
16, SOHO SQUARE, } LONDON
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.
J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
Lists may be obtained on application to
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JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
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WET AND DRY GAS-METERS,
OF
FIRST-CLASS MATERIALS & WORKMANSHIP;
Also, STATION-METERS, PRESSURE-GAUGES, STREET-LAMPS, REGULATORS, &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM.
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
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J. & H. ROBUS,
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FOR THE
ERECTION OF NEW & REMODELLING OF EXISTING GAS-WORKS.
RETORT-SETTING A SPECIALITÉ.
RETORTS SET, AND GUARANTEED TO BURN OFF A CERTAIN AMOUNT OF COAL, OR ELSE NO MONEY TAKEN FOR THE CONTRACT.
PLANS ON APPLICATION.
Retort-Setters sent to all parts of Europe and America.
Address, J. and H. ROBUS,
BELL GREEN, CATFORD, LONDON, S.E.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
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LONDON, 1862. CLASS X.
LONDON, 1862. CLASS XXXI.
PARIS, 1867. SILVER MEDAL.
AMSTERDAM, 1869.
DIPLOMA D'EXCELLENCE.
VIENNA, 1873. THE ONLY MEDAL.
MANCHESTER. SILVER MEDAL. 1875.

GEORGE GLOVER & CO.,
MANUFACTURERS OF
IMPROVED DRY GAS-METERS,
WARRANTED TO MEASURE CORRECTLY, AND NOT TO VARY.

EXTENSION OF PREMISES.

G. G. & Co. having had their premises entirely rebuilt, are now fairly in possession of large and commodious workshops, specially adapted to the requirements of the trade, and they are prepared to execute orders, large or small, with promptness and despatch.

THEY KEEP IN STOCK METERS OF ALL SIZES, UP TO 300 LIGHTS.

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236, GEORGE STREET, GLASGOW; and 30, LANCASTER AVENUE, MANCHESTER
AGENT FOR AUSTRALIA:
Mr. A. DEMPSTER, POST-OFFICE PLACE, MELBOURNE.

G. G. & Co. have just been awarded a SILVER MEDAL for Gas-Meters and Gas Apparatus at the Exhibition of the "Society for the Promotion of Scientific Industry," Manchester.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools.

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INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

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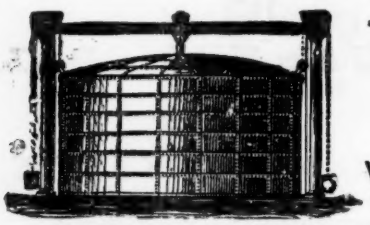

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WHITESTONE IRON-WORKS, HUDDERSFIELD

MANUFACTURERS OF

RETORTS, ANNULAR AND PIPE CONDENSERS,

WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS

GASHOLDERS,

GOVERNORS, AND ALL THE NECESSARY FITTINGS FOR COMPLETING THE ERECTION OF GAS-WORKS.

STATION & CONSUMERS WET OR DRY METERS, STREET & SERVICE MAINS, LAMP COLUMNS & BRACKETS, & WROUGHT-IRON TUBES AND FITTINGS; WROUGHT-IRON ROOFS FOR ANY SIZE OF BUILDINGS.

Sole Makers of B. W. Thurston's Combined Condensing, Scrubbing, and Washing Apparatus,

AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

REFERENCES TO UPWARDS OF 300 GAS-WORKS.

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NEAR LEEDS,

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FIRE GOODS, and Salt-Glazed Drain-Pipes.

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Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

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GLOBE TUBE-WORKS, WEDNESBURY; & VICTORIA TUBE-WORKS, GREAT BRIDGE, STAFFORDSHIRE,

MANUFACTURERS OF

PATENT WELDED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

GAS-FITTERS TOOLS, STEAM COCKS, AND ALL KINDS OF JOINTS.

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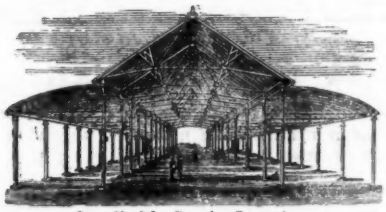

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BUILDINGS, AND SHEDDING,

For which Estimates will be given on application,

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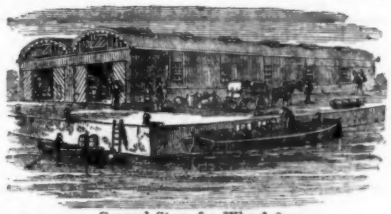
PREPARED TO PLAN FOR ERECTION ABROAD,

EITHER WITH

TIMBER FRAMING or WHOLLY in IRON.



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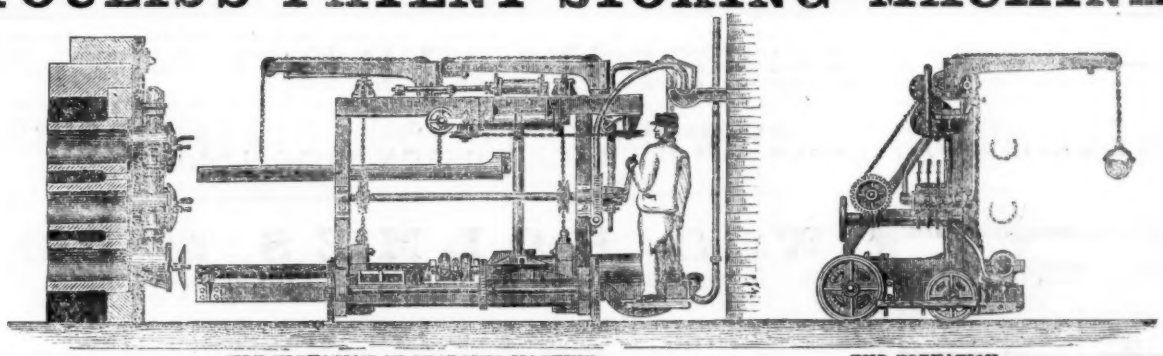
LONDON OFFICE: 1, DELAHAY STREET (First door out of Great George Street), WESTMINSTER, S.W.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION.

(The Drawing Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

WILLEY AND FORD,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDLÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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THE

IMPERIAL METER COMPANY,

LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

TO GAS COMPANIES, ENGINEERS, &c.

These Works are in full operation, and it will be the aim of the New Company not only to keep up the excellent workmanship of their predecessors, but, by the introduction of special machinery, to manufacture **Meters of a higher standard than is usually given, without increasing the cost.**

Special attention is invited to the Compensating Wet Gas-Meter of De Castro and Burton, which is now becoming so generally adopted, and is more simple in construction than any other Compensating or Ordinary Wet Meter. There is but one centre of friction to be overcome by the gas. By its self-adjusting principle it maintains an unvarying water-line; and the reservoir contains sufficient water to supply the Meter for twelve months without attention. It is unaffected by "tilting," and cannot be "flooded" by any pressure.

The Company also manufacture Dry Meters upon the most improved principle, and all their Meters being made to standard gauges, the most accurate measurement is obtained.

Attention is also called to their Dry Meters in Wood Cases, as used by some of the London Gas Companies. These Cases are a great preservation to Tin-plate Meters, especially in seaport towns, where the air is impregnated with salt; they are also particularly suited for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

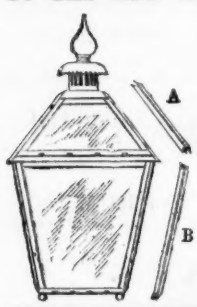
JOSEPH AIRD,

WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

TO GAS AND RAILWAY COMPANIES, LOCAL BOARDS, ENGINEERS, CONTRACTORS, SHIPPERS, &c.



WILLIAM KEEN,

SOLE PROPRIETOR AND MAKER OF

KEEN'S PATENT DOUBLE-FRAME CLIP-LAMP,

AND MANUFACTURER OF

EVERY DESCRIPTION OF STREET-LAMPS.

FOR PARTICULARS, APPLY TO

W. KEEN, 23, ROBERTSON ST., & 5 & 6, PRIORY STREET, HASTINGS, SUSSEX.

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GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WARNER AND COWAN'S
SELF-REGULATING GAS-METER,

PATENTED IN

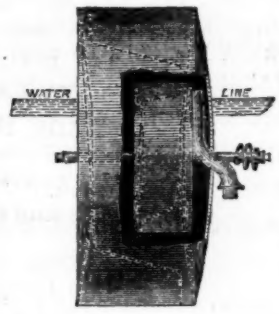
GREAT BRITAIN, FRANCE, AUSTRIA, PRUSSIA, BELGIUM, AND THE UNITED STATES.

OPINION

OF

W. RICHARDS, Esq., London, Inventor of the Dry Gas-Meter.

"Your improvement in the Wet Meter is decidedly the best that has been introduced since its invention; exceedingly beautiful and simple, which renders the instrument mathematically correct, and infinitely more accurate than any means in general usage for the measurement of liquids."



OPINION

OF

WILLIAM MANN, Esq., late Superintendent of the Chartered Gas-Works, Blackfriars, London.

"I saw a model of your Wheel to day,* and certainly think it the best addition that the Wet Meter has received since its invention, to ensure correct registration until the closing of the valve."

* Sept. 8, 1874.

From "THE JOURNAL OF GAS LIGHTING," Jan. 5, 1875.

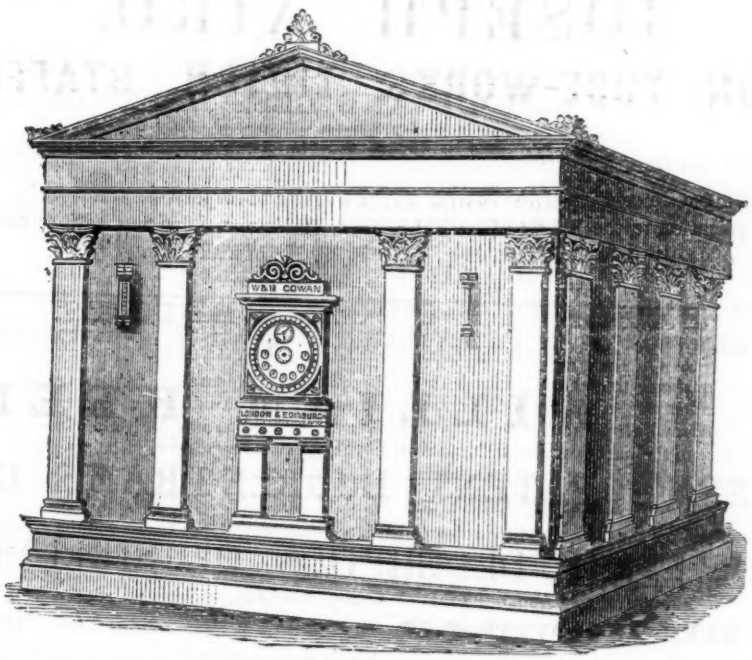
"The changes effected in the construction of the wet meter are such that it now occupies a position which it never held before—that of an unvarying measure. . . . . Both company and consumer are now equally protected, perfect accuracy of measurement is obtained, and that, too, without the least increase of mechanism, or the action of the meter in the least degree being prejudicially affected."

BRITISH ASSOCIATION OF GAS MANAGERS, Leeds, 1875.
Inaugural Address of the President,
JAMES PATERSON, Esq., F.G.S., of Warrington.

"There are, however, degrees of what may properly be termed excellence; and this leads me to notice one of the most beautiful applications which science has yet devised in the construction of the meter, and which has rendered it an absolutely reliable and unvarying instrument. . . . . The object aimed at, and most admirably accomplished, is to change the varying measurement of a varying water-line to an unvarying measure with a varying water-line and annulus."

Original Licensees and Manufacturers: W. & B. COWAN.

EITHER WITH COMMON DRUM OR



WARNER AND COWAN'S SELF-REGULATING DRUM.

W. & B. COWAN'S SQUARE STATION-METER with PLANED JOINTS.

W. & B. COWAN'S large and increasing Export Trade is provided for by their keeping constantly on hand a very large stock of both Wet and Dry Meters, ready for immediate despatch to the British Colonies and Foreign Countries.

W. & B. COWAN,

ESTABLISHED 1827,

KING HENRY'S WALK,
BALLS POND ROAD,
(NEAR DALSTON JUNCTION STATION) **LONDON, N.**

BUCCLEUCH ST. WORKS, EDINBURGH.

WEST'S GAS IMPROVEMENT COMPANY,
LIMITED.

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AMBROSE WARDE, Esq., West Farleigh, Kent, Chairman.
CHARLES ARKCOLL, Esq., J.P., Maidstone, Kent.
GEORGE EDMETT, Esq., J.P., Maidstone, Kent.
RICHARD MORRIS, Esq., J.P., Doncaster.
JONATHAN HARRISON, Jun., Esq., Brandes-Burton, Hull.

MANAGING DIRECTOR—JOHN WEST, Esq., Maidstone.

CONSULTING ENGINEER—R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W.

ENGINEER AND ANALYST—F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

BANKERS—LONDON AND COUNTY BANK, Maidstone.

THE COMPANY ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.
INCREASED YIELD PER RETORT.
INCREASED BULK OF COKE FOR SALE.
REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to R. P. SPICE, Esq., or to F. W. HARTLEY, Esq.

EXTRACTS FROM REPORTS.

MAIDSTONE GAS COMPANY, Aug. 31, 1875.

"It was a fortunate circumstance that the company had the benefit of this Apparatus, for during a portion of the year there was great difficulty about coals, and it was even impossible at one time to obtain the kind of coal contracted for. The new Apparatus facilitated the distillation of coals, which without it would probably have produced an inferior yield of gas.

"The directors have twice in the past year found themselves in the satisfactory position of being able to reduce the price of gas."

Messrs. LIVESEY and WOODALL, Aug. 28, 1873.

"The little waggon containing the charge, which is propelled into the retort, deposits the coal in a perfectly even layer upon the bottom of the retort, and that in a shorter time than is occupied when two scoops are used for the same purpose. The perfectly level surface of the resulting coke permits the use of an ingenious rake, designed by Mr. West, by which the whole charge is completely withdrawn in one motion. By the use of this Apparatus the labour required in carbonizing is reduced from 8 to 10 per cent. per ton of coal, and is also of a less exhaustive character for the stokers."

F. W. HARTLEY, Esq., A. Inst. C.E., Sept. 5, 1875.

"Any company working on Mr. West's system would be much less dependent than is the usual case on the assistance of skilled stokers, inasmuch as men who had never charged a retort in their lives could after a very few trials charge and draw retorts perfectly, and would be able to continue the work from the absence of anything like the tax on their physical powers which the system of scoop or shovel charging and rake-drawing involves, and there would be moreover a considerable saving in the cost of labour, inasmuch as a gang of men would certainly be able to attend to a greater number of retorts.

"In respect to cost of wear and tear of retorts and the charging and drawing appliances, there is, in my opinion, no reason to believe that it will be greater than with the old system, but on the contrary that it will be reduced.

"If the system be properly applied, considerable advantages must accrue to the companies who work with it."

R. P. SPICE, Esq., M. Inst. C.E., Oct. 12, 1875.

"And finally, as to the quantity of gas produced and its quality; the improved results are such as all rational, well-informed men would expect from working off charges of coal deposited *evenly* and in a *thin layer* on the bottom of the retort, in two-thirds the time requisite to carbonize the same quantity laid in a thick mass, not evenly or uniformly deposited; and briefly, those which I found were 10,300 feet of 16-candle gas obtained from Holmside coals.

"I will only add that I shall certainly take the earliest opportunity I may have of giving practical proof of my good opinion of the invention, by introducing it in the course of my practice, and heartily wish the inventor and the shareholders in the undertaking great success, which I consider they richly deserve."

TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

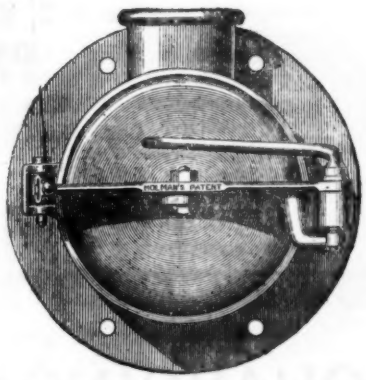
SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS,

Anti-Friction Catches and Eccentric Fastenings.



INSTANTANEOUS SEALING EFFECTED.
NO LUTING. NO DUPLICATE LIDS REQUIRED.
HOLMAN'S NEW SELF-SUSTAINING CROSS-BAR ENSURES FREEDOM OF JOINT AND MAINTAINS PARALLEL POSITION OF THE LIDS.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 20,000 being in use at various Gas-Works in London and the Provinces, among which may be mentioned:—

The Gaslight Co., Beckton (where, by the end of 1875, nearly 4000 will be in use).
" Gaslight Co., Bow Common.
" Gaslight Co., Silvertown.
" Gaslight Co., Lupus Street.
" London Gaslight Co.
" Independent do.
" Phœnix do.
" South Metropolitan Gaslight Co.
" Commercial do.
" Imperial do.
" West Ham Gas Co.
" Gas-Works, Barnet.

The Gas-Works, Royal Arsenal, Woolwich.
" do. Lower Sydenham.
" do. Brentford.
" Consumers Gas Co., Woolwich.
" Alliance and Dublin Gas-Works.
" Edinburgh do.
" Manchester Corporation do.
" Salford do. do.
" Rochdale do. do.
" Liverpool Gas-Works.
" Birmingham do.
" Birkenhead do.
" Nottingham do.

The Newcastle-on-Tyne Gas-Works.
" Lurgan do.
" Carmarthen Gas-Works.
" Merthyr Tydfil do.
" Windsor do.
" Leeds do.
" St. Albans do.
" Over Darwen do.
" Rotherham do.
" Aylesbury do.
" Bournemouth do.
" Ystrad do.
" Cardiff do.
" Rochester do.

The Keighley Gas-Works.
" Aberdare do.
" Ballymena do.
" Richmond do.
" Stalybridge do.
" Longton do.
" Exeter do.
" Ross do.
" Falmouth do.
" Barrow-in-Furness do.
" Belfast do.
" Wakefield do.
And other Provincial and Foreign Gas-Works.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (Commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,
(Signed) G. C. TREWBY.

VIENNA EXHIBITION, 1873.—The highest prize and only Medal "for Progress" for Direct-Acting Steam Pumps for general purposes was awarded to TANGYE BROTHERS AND HOLMAN, Engineers, London, for

THE "SPECIAL" DIRECT-ACTING STEAM PUMPS.

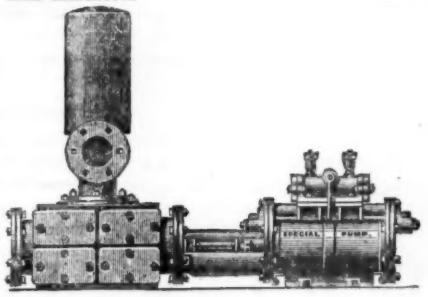
Upwards of 12,000 have been sold in England and America.

In use in upwards of a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Intending Purchasers are particularly requested to observe the great length of stroke of these Pumps, as compared with the short stroke of Pumps of other makers, as the durability of the machine greatly depends upon this.

The following sizes are those usually supplied to Gas-Works. Those marked, * being usually selected for pumping Tar and Liquor, are nearly always in stock, fitted up expressly with Pump details in iron, and extra length distance-piece between steam and pump cylinders, at a small extra cost.

Diameter of Steam Cylinder . in.	3	*4	*5	*6	5	*7	6	*8	7	*10	10
Diameter of Water Cylinder . "	1¼	2	3	4	5	5	6	6	7	7	8
Length of Stroke . . . . . "	9	9	12	12	12	12	12	12	12	12	18
Gallons per hour approximate .	450	815	1830	3250	5070	5070	7330	7330	9750	9750	13000
REDUCED PRICES. . . .	£16	£18	£22 10	£30	£27 10	£40	£40	£50	£50	£65	£75

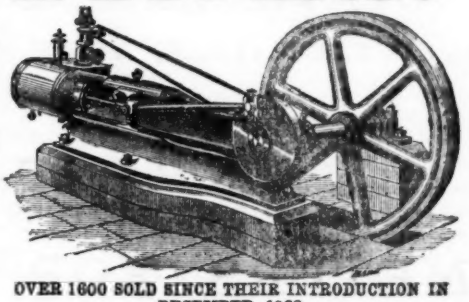


TANGYE'S HORIZONTAL HIGH-PRESSURE EXPANSIVE

STEAM-ENGINES.

In designing this Engine the utmost regard has been paid to simplicity of arrangement, strength of construction, and economy in cost. The working parts are considerably reduced in number, as compared with Horizontal Engines generally, rendering it far more durable and compact, the bed-plate, front cylinder cover, guides, and plummer-block for crank-shaft bearing being all cast in one piece, which in design and proportions is admitted by competent engineers to be perfect, and to afford a strength and rigidity that cannot possibly be attained in the best fitted engines of the ordinary horizontal type. The extraordinary stiffness of this Engine will permit of its being driven at a much greater maximum speed than engines generally, and with far less wear and tear. The cylinder with its valve-chest is bolted to the end of the bed. The cross-head slippers and connecting-rod ends are made adjustable, so that any wear can be readily taken up. The fly-wheel, cylinder-end, connecting-rod, and crank-plate, are all bright. All the parts are made to Whitworth's Gauges, and the material and workmanship are of the highest class throughout.

The Governor is of a very special description, and combines in the small space usually occupied by the ordinary steam stop-valve, a governor, throttle-valve, and stop-valve complete. It is exceedingly sensitive, simple, and compact.



These Engines are adopted in Gas-Works at Greenwich (Phœnix Gas Co.), Haggerston (Independent Gas Co.), Nine Elms (London Gas Co.), Falmouth, Harrow, Jersey, Plymouth, Richmond, Rochdale, Santiago (Chili), &c.

OVER 1600 SOLD SINCE THEIR INTRODUCTION IN DECEMBER, 1869.

London 1851. New York, 1853 Paris, 1855. London, 1862.

Dublin, 1865

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

Circular to Gas Companies:— PAGE
Prospective Legislation on Metropolitan Gas Matters . . . 9
A Letter by Mr. G. Livesey . . . 9
Completion of the Purchase of the Birmingham and Staffordshire Gas Company by the Birmingham Corporation . . . 10
Gas Affairs at Lichfield . . . 10
Gas Affairs at Leeds . . . 10
Water and Sanitary Notes:—
Earl Camperdown and the London Water Supply . . . 10
Dr. H. Sandwith on the London Water Supply . . . 10
Dr. Buchanan at Croydon . . . 10
Leading Articles:—
The Storeage of Petroleum . . . 11
A Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas . . . 11
Correspondence:—
Gas-Exhausters and the Deposit of Carbon in Retorts . . . 13
Working Drawings of Retort Settings . . . 15
Gas-Burner Testings at Leeds . . . 15
Gas Accounts . . . 15
Governors to Meter Lamps . . . 15
Our Christmas Appeal . . . 15
Legal Intelligence:—
Chesterfield Police Court—Conviction of a Lamplighter for Neglecting Work . . . 15
Macclesfield Police Court—Convictions for Neglecting Work . . . 15
Miscellaneous News:—
"A Christmas Appeal" . . . 15
Metropolis Gas Supply . . . 16
Gas Lighting at Oughty-Bridge . . . 16
Metropolis Water Supply . . . 16
American Gaslight Association . . . 16
The Combustion of Coal Gas, and the Theory and Construction of Flames . . . 18
On the Value of Petroleum and Coal Tar in the Manufacture of Coal Gas. By Professor A. Wagner . . . 21
Gas Explosion at Birmingham . . . 21
Waste of Water at Glasgow . . . 22
Trade Reports . . . 22
Reductions in the Price of Gas . . . 23
Rotherham Sewage . . . 23
Carmarthen Sewerage Works . . . 23
Gas Explosion in Boston, U.S.A. . . . 23
Gas for Heating Purposes . . . 23
Protection from Fire . . . 23
Folkestone Gas Company . . . 23
Birmingham Corporation Gas-Works . . . 24
Hull Corporation Water-Works . . . 24
Register of New Patents:—
Stringfellow, H. W.—Drain-Pipes . . . 24
Bonneford, A.—Water-Meters . . . 24
Deacon, G. F.—Measuring Water in Pipes . . . 24
Dick, A.—Air or Gas Spring and Stuffing-Box . . . 24
Kidd, J.—Gas-Making . . . 24
Abel, C. D.—Gas Motor Engines . . . 24
Rowland, E.—Compressing Air, Raising and Forcing Fluids, &c. . . . 25
Boulton, M. P. W.—Hot Gas and Steam Engines . . . 25
Bowers and Fyfe—Gas-Making . . . 25
Weatherdon, B. F.—Disinfectants . . . 25
Higginson, A.—Motive-Power Engines and Pumps . . . 25
Sellars, J. C.—Cement . . . 25
Scott, H. Y. D.—Purifying Gas . . . 25
Cave, J. O'C.—Automatic Governor for Regulating the Flow of Air, Gas, Water, and other Fluids . . . 25
Rydill, G.—Purifying Sewage, &c. . . . 25
Newton, H. E.—Gas-Burners . . . 25
Johnson, S. H.—Cocks or Valves . . . 25
Vera, P.—Gas or Hot Air Engines . . . 25
Waller, G.—Gas-Making . . . 25
Taylor, G. N.—Lamps . . . 26
Ross, O. C. D.—Utilizing Petroleum as Fuel . . . 26
Clark, J. L.—Gas-Regulators, &c. . . . 26
Taunton, Hayward, and Knap—Wrought-Iron Tubes . . . 26
Johnson, J. C.—Forming Tube Skelps . . . 26
Dorat, H. J.—Gas-Burners, &c. . . . 26
Mather, J.—Air Gas Making . . . 26
Box, Aubertin, Boblique, and Leplay—Disinfecting Sewage, &c. . . . 26
Applications for Letters Patent . . . 26
Patents which have passed the Great Seal . . . 26
Patents which have become void . . . 26
Share List of Metropolitan Gas and Water Companies . . . 26

NOTICE TO SUBSCRIBERS.

Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the year 1876, are reminded that this can only be done during January.

Vol. XXVI. (second half of 1875) will shortly be ready, bound in cloth, gilt letters, price 18s. Cloth cases for binding may be obtained on order from any bookseller, or from the Publisher.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 4, 1876.

Circular to Gas Companies.

THE gay and festive season, through which we are now passing, brings pleasure, if not profit, to most; but it is not prolific of information on the matters which most concern us. All, having rested and feasted, will soon be preparing to shape the events of the present year. And what will they be? That another inquiry by a committee of the House of Commons, on the metropolitan gas question, is imminent, may be taken for certain. There will be, at least, three Bills before the House—that of the Chartered Company, the chief provisions of which we have already noticed; that of the South Metropolitan Company, with the provisions of which we are not yet acquainted, but which may be expected to follow the lines of the Act obtained by the Commercial Company last session; and also the Regulations Bill of the Metropolitan Board of Works, in the promotion of which they may, or may not, be assisted by the Corporation of the City of London. There is, beyond this, a somewhat vague rumour—referred to before—of a Bill to be brought in by Government, to place all the companies under one direction, with a view to promote their economical management. This last-named measure would hardly be brought under the notice of a select committee of the House of Commons; but the other Bills we have named must give another committee the opportunity of reconsidering the decision arrived at by that which sat last session.

The Bill of the Chartered Company expresses concurrence in the principle of the sliding scale, and this, we happen to know, has excited so much suspicion in the minds of some who have been favourable to the Regulations Bill, that they are disposed to withdraw from its support; and, as a matter of course, oppose the Bill of the company. It will presently be seen how far the opposition will be carried, and what course will be pursued; but the fact remains, that the ready acceptance of the sliding scale by the Chartered Company has given rise to a suspicion, that its adoption would not be so much to the advantage of consumers, as some have endeavoured to persuade the public. There is, in fact, we have reason to believe, in all but interested quarters, a strong belief that, if the gas undertakings remain in the hands of the companies, only some small modifications of existing legislation are necessary to fully protect the interests of consumers. Such changes in opinion are not surprising. We have seen them take place before, and shall witness them again. Thus, the support of the district authorities to the Regulations Bill next session is by no means assured; and, failing that, opposition to the Bills of the South Metropolitan and Chartered Companies is certain to be made.

The former will, of course, propose the sliding scale, with the initial price of 3s. 9d. per 1000 feet. With the proposal made in the Chartered Company's Bill—viz., that no diminution of dividend shall take place, unless the price charged shall exceed 4s. per 1000 feet, and no increase shall be allowed, unless a lower price than 3s. 6d. is charged—we have before expressed our unqualified approval. Having regard to special circumstances, this seems to us a perfectly fair proposal, and one which is likely to receive the sanction of Parliament. A similar proposal might come, with a very good grace, from the South Metropolitan Company, who would thereby exhibit less disposition to avail themselves of the accidental advantages they possess. What arrangement, as regards new capital, may be proposed by the last-named company, we do not know; but we may presume it will be desired to raise half by way of shares, at 7 per cent., and the other half by way of mortgage, at interest not to exceed 5 per cent. The Chartered Company wish for power to borrow money at 6 per cent. They have before honestly tried to borrow at 4½ per cent., but met with no success; hence, possibly, their desire to have a higher rate justified, which they have no wish to pay, if it can be avoided. We do not expect that they will be able to borrow at less than 5 per cent., and not for that, if mortgage debts go on increasing in the way they promise to do.

The question of possible purchase may remain as we left it last week, with this remark, that the essentially communistic character of such a transaction, which we have before pointed out, is beginning to be recognized. The cry to-day is, that gas and water are essentials to life, and that it is the duty of local authorities to supply them at the lowest possible cost. It may be discovered to-morrow that beef and bread are essentials, and it may be urged that it is the duty of authorities to supply these also. We do not see what answer could be made to the demand. The system of the supply of necessaries by local authorities, if carried out to the logical consequences, would involve co-operative plans, in which trade, as we ordinarily understand it, would completely disappear—with what results we shall leave tradesmen and capitalists to guess. That a reaction, in public opinion, on this question will take place, we feel assured, and for that reason we must recommend metropolitan gas proprietors not to calculate on the undertakings being bought up for maximum dividends. Popular opinion varies as the wind, and straws serve to show the direction.

We make no apology for reproducing, in another column, a letter addressed to a contemporary by Mr. G. Livesey, for whatever that gentleman writes, whether on the science or politics of gas affairs, is deserving of attention. No one will be surprised to see that Mr. Livesey adheres to the sliding scale. He is what Mr. Carlyle would call "a man with a fixed idea." He sticks to his opinions with remarkable tenacity, and expresses them with courage. It is a somewhat novel notion, that the sliding scale would convert gas companies from "day-workers" into "piece-workers." We have not the antipathy to "piecework" that the trades unions display, and it must be pointed out that the question in our case is not so much that of skill, as of capital and opportunity. As regards skill, it must, we think, be admitted that the metropolitan companies are pretty much on an equality. It is the amount of capital on which dividends have to be paid, and the opportunities the companies possess for the profitable disposal of residuals that governs the price of gas. If skill alone could control the price, we might, while admitting the force of some

trades unionist arguments, concede that superior skill should have a superior reward. But skill, as we have said, has little or nothing to do with it; accident, we might almost say, has settled the present conditions of the metropolitan gas companies, and the sliding scale would simply confer advantages in consequence of circumstances which must be regarded as almost fortuitous. It would seem, at first sight, a very reasonable thing, that if a gas company give £3000 to their consumers, they should have the right to appropriate £1000 to themselves. But the fact is that it would be no gift at all, for the present law says that the whole £4000 belongs to the consumers. And then as to the question upon whom any additional cost of production should fall—by all the laws of trade it should fall on the consumer. In these days of dear beef, it is the consumer who suffers. If the stock feeder or butcher suffers, it is only in consequence of the restricted consumption which results from high prices, and gas companies have actually suffered from the same cause.

We are glad to see that Mr. Livesey expresses a qualified agreement with us as to the advantages to be derived from working up residuals. We have no doubt in our minds that, in the event of a complete amalgamation, large additions to revenue might be made by this means, which should be applied to the reduction of the price of gas. A fleet of screw-colliers might also, no doubt, be employed with advantage, and the amalgamated company might, with profit and propriety, become the lessees of coal mines. By such means we feel certain that complete amalgamation would, at no distant time, confer great benefits on the consumer, although, it may be admitted, that partial combination has not done so. Half measures never answer; to be successful you must be thorough, and if real good is to come of amalgamation, it must be complete.

Mr. Livesey seems to think that two companies may stand out from amalgamation. As regards his own company, with whose circumstances he is so perfectly acquainted, we may admit that he might make out a strong case for a continued independent existence; but as regards the other, obviously pointed out, we have a strong idea that if amalgamation were *pushed*, the directors would see it to their interest to enter meekly into the arrangement. We must wait, however, to see what will turn up in the course of the inquiry by the next select committee on the Regulations and other Bills.

On one point we are in full accord with Mr. Livesey. We have, in past years, expressed a strong objection to the concentration of gas-works in a few huge establishments. Our idea has always been that London could be best served with gas from fifteen or twenty moderate-sized works, conveniently disposed in and around the metropolis. The danger which Mr. Livesey foresees is no fanciful one. A few pickaxes and a pound or two of nitroglycerine might, as things are, plunge the greater part of London in darkness in a minute or two. It will be well, then, not to add to the danger—remote as it may appear—by further concentration. Whether London can be best served by one or two large, or six moderate-sized companies, we shall not stop here to inquire. Our faith is pinned to one general company, with many works, the mains from which shall all anastomose, and yet be capable of isolation. In that way, the danger which Mr. Livesey foresees may be reduced to the smallest dimensions. It would only be in case of an organized insurrection, which London will, no doubt, some day witness, that universal darkness could be made to prevail.

There is not a gas manager in the metropolis who will not sympathize with Mr. Livesey in his lament over the "sulphur" difficulty. All are worried pretty much alike, though all are not afflicted with Referees. But life, it has been said, is full of "compensations," and certainly a good salary must be some compensation for much work and some worry. Why, however, the "sulphur" difficulty, as it is called, should cause so much worry, we altogether fail to see. The effectual removal of the *known* sulphur compounds, without nuisance, is only a question of pounds, shillings, and pence; and if consumers insist on gas with a minimum amount of sulphur, they must be made to pay accordingly. We know very well that, when the gas-works come into the possession of a municipality, the sulphur hubbub will cease; but that will not convince us that sulphur products are not objectionable in gas. A little candid inquiry will satisfy any man, that it is best to eliminate all that can possibly be got rid of.

If the result of general amalgamation or purchase should be the retirement of Mr. Livesey from the gas world, we should much regret it. His intelligence, energy, and honesty of purpose may be long employed to the advantage of the public; and into whose hands soever the undertakings fall, we are certain they will be anxious to retain his services. Let us hope, then, that he will reconsider the determination at which he has apparently arrived, and that we may not have to record his technical decease as a gas manager, and write, as we must, after the announcement—"*Requiescat in pace*—far removed from fumes of sulphur."

On the 1st inst., the Corporation of Birmingham completed the purchase of the Birmingham and Staffordshire Gas Company, by handing over to the directors certificates of annuities, to replace shares, equal to a dividend of £56,415 a year. Cash to the amount of £65,515 was also paid over, to be distributed among the shareholders. We have said before that the companies are very well satisfied, and we may add now that the purchase is very popular in the town. An allusion to it in the pantomime at the Theatre Royal is nightly applauded, and, strange to say, an opinion expressed that "no *public* good can "come through *private* hands," receives applause in a town which owes everything to private enterprise. It is said that the demand for gas has greatly increased since the undertakings came into the hands of the Corporation, the reason for which may be easily imagined.

Great dissatisfaction is expressed with the gas supply of Lichfield, and a new company is threatened. Unfortunately the existing company have neglected the obvious duty of getting a special Act of Incorporation or a Provisional Order, and they are, in consequence, somewhat at the mercy of their antagonists. It is now too late for them to think of obtaining parliamentary powers this session; but as their opponents could hardly commence operations in less than twelve months, they might be preparing a measure for next session, and, in the meantime, doing their best to remove the present grounds of complaint. This case may serve as a warning. No gas company in these days should be without statutory powers. Every company of importance should have a special Act, and the smaller, can, at a trifling expense, obtain a Provisional Order, under the Gas and Water Works Facilities Act, which, when confirmed by Parliament, is almost equivalent to a special Act. An application for one or the other should not be deferred until opposition arises.

As we supposed would be the case, the gas agitation in Leeds is subsiding, and consumers appear to be convinced that the fault is not so much in the gas as in the burners they employ. We commend the action of Mr. Woodall, the gas engineer of the Corporation, to the notice of gas companies. Innumerable complaints would be prevented if the companies took a little trouble in instructing their customers as to the burners they should use.

Water and Sanitary Notes.

The Earl of Camperdown has renewed his attack on the London water companies, or we may, perhaps, now say, on London water. He has adopted all the conclusions of the Rivers Pollution Commission, and is of opinion that the sources of our water supply should be instantly changed. He, further, endorses the opinion of the Birmingham pantomimist, and says, in effect, that "no "public good can come from private hands," and he, therefore, makes a sort of suggestion, that the water supply of the metropolis should be placed under the control of some central authority. The misfortune is, and Lord Camperdown seems to acknowledge it, that London has no central authority deserving of the smallest respect. On this point we shall say nothing more to-day. The issue, however, which Earl Camperdown places before the metropolitan ratepayers is an exceedingly simple one. The sources must be changed, and the water supply must be placed in the hands of a central authority. It may possibly be, that an adequate supply of deep well water for the metropolis could be obtained by an expenditure of four or five millions of money. How long the supply would last, if continuously drawn upon, at the rate now furnished to London, we shall not undertake to say. All but one of the existing water companies would have to be bought up, and their purchase would cost about twenty millions. Thus, at the cost of some twenty-five millions, the metropolis might, in the course of another ten or twenty years, have a fresh supply of water. But would the healthiest large city in the world be, in the least degree, better off for it? We think not; but the metropolitan ratepayer is at liberty to change the sources of his supply, if he think fit.

Dr. Humphry Sandwith has also a fling at the company which supplies the Athenæum Club with water; and he, too, very naturally, from his associations, contends that water should no longer be doled out by trading companies, and that our drinking water should be drawn from better sources. We shall presently endeavour to show that the grounds on which the metropolitan waters are condemned, are utterly untrustworthy, and that the chemical analyses on which the condemnation is based, are altogether unreliable. Common sense revolts against the nonsense written for the simple purpose of achieving notoriety, and prolonging the existence of Government commissions.

Dr. Buchanan has commenced his inquiry into the causes of the outbreak of typhoid fever at Croydon. It promises to be exhaust-

ing, if not exhaustive. Two days have been spent in receiving suggestions, which it might be supposed a physician well up in hygienic matters would not require. Most of the suggestions made, point to water as the distributor of the disease, and it is important to know (we are dependent on a newspaper report for our information) that the learned commissioner has been "opening "fire-plugs, water-mains, and taps of one kind or another," in order to ascertain how the disease has been spread. We shall hear in time the conclusions he has arrived at, and, doubtless, they will lead to important consequences. If his suggestions are followed, we believe that Croydon will be free from typhoid fever—until another outbreak occurs.

THE STOREAGE OF PETROLEUM.

The recent destruction of the training-ship *Goliath*, caused by the accidental upsetting of a petroleum lamp, once more forcibly draws public attention to the question of the safe custody of the material consumed in the lamps. We, therefore, do not hesitate to make it the occasion of a notice of an able report, made some time ago, by Mr. Keates, to the Metropolitan Board of Works.*

The Acts for the safe keeping of petroleum, from the first, passed in 1862, down to the present, first enacted in 1871, and now kept alive from year to year, enacts as follows:—"Petroleum, "for the purposes of this Act, shall include any product thereof "that gives off an inflammable vapour at a temperature of less "than one hundred degrees of Fahrenheit's thermometer." We might stop here to raise a quibble, and argue that the term "petroleum," while including the lighter and more inflammable *products thereof*, which might pass under another denomination—"benzoline," for instance—does not exclude anything which is, in fact, "petroleum." It has, however, been accepted as a fact that, for legal purposes, the word "petroleum" means something that will give off an inflammable vapour at less than 100° Fahr.; and it has been enacted, that not more than 40 gallons of such a liquid shall be stored within 50 yards of a dwelling-house, without a special licence from a local authority.

The definition appears to be wonderfully sharp. Petroleum which inflames at 99° Fahr. cannot be kept without a licence. Petroleum which ignites at 101° Fahr. may be stored anywhere, and in any quantity, with impunity, and without any restrictions. The absurdity of such an enactment becomes apparent when we know that it is probable that no two experimenters will agree as to the flashing point, and are likely to differ by several degrees. The case of the *Goliath* also proves that a "petroleum," the flashing point of which is 144° Fahr., is a highly dangerous material. Mr. Keates is, therefore, perfectly right in contending that every kind of petroleum or kindred liquid, as mentioned in the Act, should be regarded as petroleum within the meaning of the Act, and ought not to be stored without licence, and under conditions. The point will, no doubt, be strongly contested; but we hope that the Metropolitan Board of Works will, next session, make a serious effort to get the Petroleum Act so amended, as to make it clear that petroleum means petroleum. Mr. Keates makes some further suggestions as to the admission of petroleum ships to the Port of London, with which we entirely agree. At the present moment the Conservators will not allow the ships to come higher than Thames Haven, if the cargo consists of spirit which will inflame under the standard degree; but a vessel may anchor in the Pool, or come up to London Bridge, if it contain petroleum which, it is reported, will not ignite under 101° Fahr. The absurdity, we say again, is palpable. Mr. Keates says, with truth, that in the immediate vicinity of London there are places eminently fitted for storing petroleum, and easily accessible by water. "At these places suitable stores and warehouses "might be fitted up, and the storeage of petroleum might "be made to any extent with safety; at least, whatever happened, "the danger and damage might be limited with certainty to the "storeage premises." We are not quite certain what Mr. Keates means by a warehouse. If he would allow petroleum to be stored on upper floors, we entirely differ from him. We hold a strong opinion that the liquid should only be stored on a ground floor. In the case of a fire in a warehouse of several storeys, with hundreds of barrels of petroleum on each, a fire might send thousands of gallons of blazing spirits over a neighbourhood, with results that cannot be guessed. We think, too, that a licence might be made conditional on keeping a large quantity of wet sand on the premises, with a plentiful supply of shovels; for if a fire broke out, water would be of no use. On all other points we fully endorse the opinions of Mr. Keates, and hope the Metropolitan Board will take action in accordance with the views of their able officer.

* "Report by Mr. Keates upon the General Question of the Storeage of Petroleum within the Metropolitan Area, and upon the Conditions under which Petroleum is admitted into the Port of London."

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

LXXVII.

GASHOLDERS.

The accompanying engravings are descriptive of the gasholder designed by Mr. G. Livesey, and recently constructed under his superintendence by Messrs. Piggott and Co., of Birmingham, at the works of the South Metropolitan Company. It is remarkable as being the largest hitherto erected without trussing to support the roof, also for the great height to which it rises, and for the elegance of the construction of the guide framing.

The first represents a half of the holder in elevation, together with its standards and girders, and a small portion in section.

The second is a plan of a fourth of the holder, with a portion of the sheets removed, in order to show the interior of the tank, the vertical stays for supporting the sides, and the timber framing which supports the roof when the holder grounds. It will be observed of this framing, that whilst it is sufficiently strong for the intended object, no material is misapplied, as the spaces between the timbers average 800 square feet, whilst, at the outer part, for a width of about nine feet, the framing is dispensed with.

The inner holder is 177 feet, and the outer holder 180 feet in diameter, the height of each being about 45 feet, and rising, when full, a height of 90 feet, the combined vessel containing 2 million cubic feet of gas. The pressure given by the inner holder is 5 inches full, and that of the outer holder 3 inches, making together, when at their greatest elevation, 8 inches, which amount of pressure, for a holder of such great depth, is very low. To attain this, as well as for considerations of economy in the construction, and perhaps to ensure the more perfect working, by avoiding unnecessary weight in the upper part, the engineer was induced to dispense with the trussing usually adopted for supporting the roof; and as the details of such a structure must be of great interest, we give a copy of the specification, with which we have been favoured.

Specification of Telescopic Gasholder to be erected for the South Metropolitan Gas Company on their Works at the Old Kent Road, London.

Extent of Contract. The contractors to provide, erect, and fix, in a good substantial gas-tight, and, in the opinion of the engineer to the gas company, satisfactory manner, all the material of and for the new gasholder, and at their own expense find, provide, and apply all scaffolding, tools, lifting and lowering tackle, and other appliances required by them in the execution of the contract.

The gas company to afford the contractors all the facilities in their power for the convenient execution of the work, to prepare the tank and foundations, build in the foundation bolts and plates, and do all masonry work.

Inner Gasholder.

The extreme diameter of the inner holder to be 177 feet, and the depth 45 feet 3 inches. The crown to rise 9 feet in the centre, and to form a true segment of a sphere.

Sheeting. The outer row of plates of the crown to be 3 feet 6 inches wide, and ⅛ inch thick, butt joints; the second row 3 feet 6 inches wide, and ¼ inch thick; the third row 3 feet 6 inches wide, ⅛ inch thick; and remainder of the top No. 8 W. G. thick.

The top row of side sheets to be ¼ inch thick, and the one next above hydraulic cup to be 5-16ths thick, the rows next each of these ⅛ inch, and the remainder No. 11 W. G. in thickness.

Top Curb. The top curb to be formed of an angle iron ring, 6 inches by 6 inches by ⅜ inch, attached to the plates of the crown and the side plates by double rivets, and another ring of angle iron, 6 inches by 3 inches by ⅛ inch, to be rivetted to the outer row of crown plates 2 feet 6 inches from the top curb.

Hydraulic Cup. The plates forming the sides and top and bottom of water-lute to be 7-16ths inch thick, and made upon Piggott's improved plan, as shown on drawing, the width to be 12 inches, and depth 21 inches, the outer edge to be strengthened by a half-round bead iron.

Vertical Bars. The vertical framing of inner gasholder to consist of 40 posts, each to be formed of two angle irons, 3 inches by 3 inches by 7-16ths inch, and plates, 5-16ths inch thick, bent to the form shown on drawing, being 18 inches wide and 18 inches deep, the back plate being 2 feet 9 inches wide, and ⅜ inch thick, which will run from top to bottom of holder.

Man-holes. To have one of Livesey's patent man-lid valves fixed over the inlet and outlet pipes, to afford access thereto when the gasholder is down, without permitting the escape of gas; and to have one or more man-lids of the ordinary kind fixed in any convenient position.

Outer Gasholder.

The extreme diameter of the outer vessel to be 180 feet, and the depth from the top of the water-lute to the under side of the bottom curb of 45 feet.

Sheeting. The top row of sheets next inverted cup and bottom row to be 5-16ths inch thick, the rows next each of these ⅛ inch thick, and the remainder No. 11 W. G. in thickness.

Hydraulic Joint. The inverted hydraulic cup to be formed in all respects similar to that specified for the inner gasholder.

Vertical Bars. The vertical framing of the outer gasholder to consist of 20 bars of channel iron, 7 inches by 3 inches by ½ inch thick, as shown, attached to the inverted hydraulic cup at the top to a ⅜ inch plate, running from the top to the bottom of the holder and to the angle iron curb at the bottom with ⅞ inch bolts, these bars to be continued 12 inches below the bottom curb, and bolted to a cast-iron bracket as shown. Also to have fixed, on the outside of holder, 20 posts formed of 5-16ths inch boiler plates and angle iron, attached to a back plate ⅜ inch thick, similar to those specified for the inner gasholder.

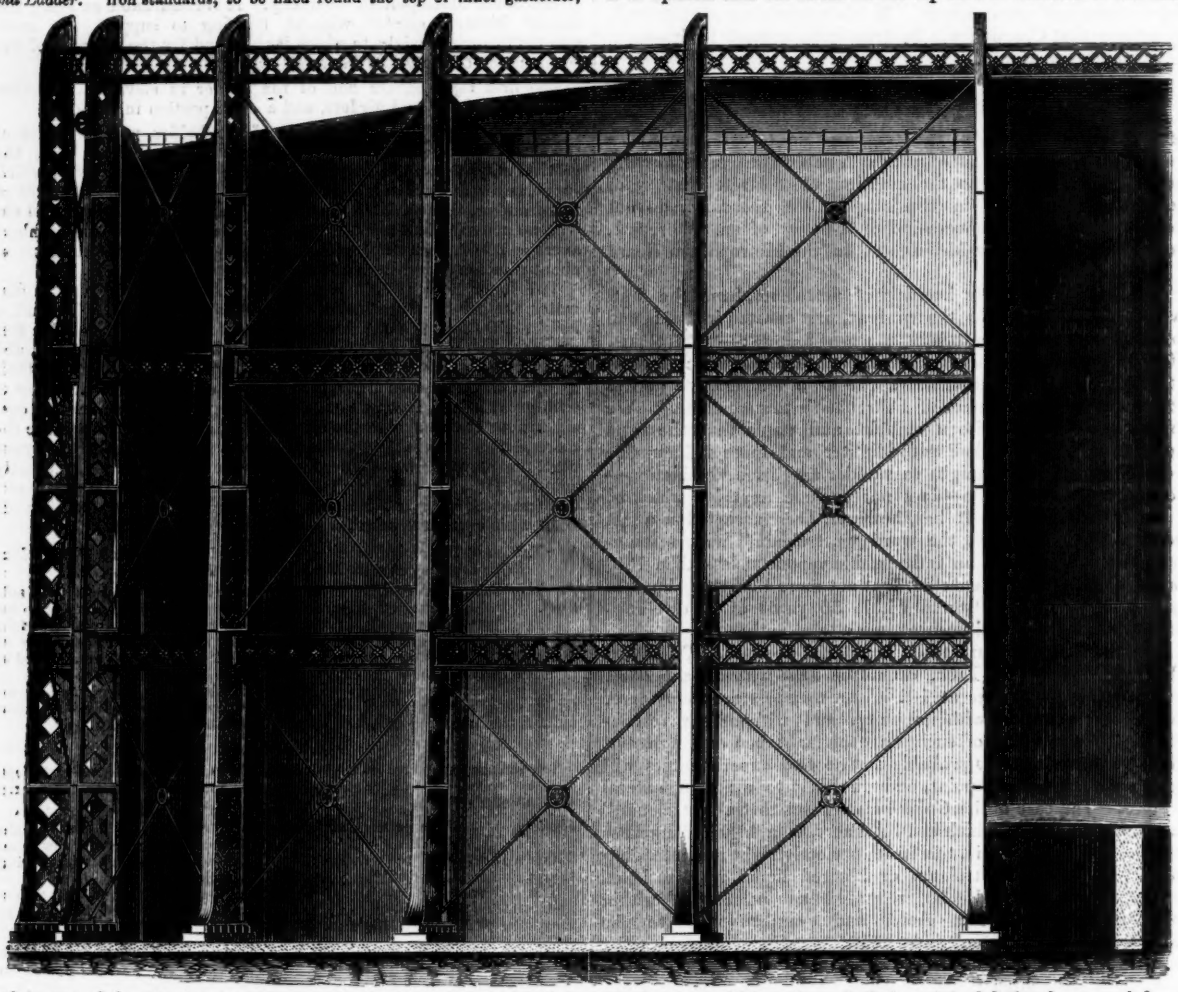
Bottom Curb. The curb at the bottom of gasholder to be formed of two complete rings of angle iron, each 5 inches by 5 inches by ⅝ inch, and two plates, each 15 inches wide and ⅝ inch thick, the upper curb to be bolted and the lower curb rivetted to the side sheets, with ⅞ inch bolts and ⅝ inch rivets respectively.

Rivets. The ordinary rivets of the sheets to be full ½ inch diameter, and the remainder of strength proportionate to the thickness of

the plates. All the joints shall be formed of the best tape, one inch wide, saturated with red lead and oil, and be made gas tight.

Rollers and Carriages. On the outer row of top plates, at equidistant points, to be fixed 20 guide rollers and carriages on cast-iron bed plates, and on the bottom of cup to be placed equidistantly 40 guide rollers and carriages. Also 20 rollers and carriages on cast bed plates, to be fixed round the top, and 40 rollers and carriages round bottom of outer gasholder, all to be very firmly fixed and bolted to their respective places, and to have the rollers and axles turned.

Handrailing and Ladder. A handrailing formed of $\frac{3}{4}$ inch round iron, supported by cast-iron standards, to be fixed round the top of inner gasholder,



and to one of the stancheons or columns to be fixed a wrought iron ladder, formed of half-round bead iron, with rounds of $\frac{3}{4}$ inch diameter.

Guide Framing.

To have twenty cast-iron open-work stancheons, as shown, to be 92 feet high when erected, 6 feet wide at bottom, rapidly reduced to 4 feet 6 inches, and to 3 feet at top. Base 6 feet by 4 feet 6 inches wide, metal in flanges 2 inches thick, and in web $1\frac{1}{2}$ inch thick.

Each stancheon to have a cast-iron channel guide, 6 inches wide, 3 inches deep, and 1 inch thick, attached to the stancheon by screw-bolts.

Tank Guides. Also to provide and fix to the wall of tank 40 trough guides of cast iron, as shown on drawing.

Foundation Bolts and Plates. Each stancheon to have a cast-iron flanged foundation-plate 6 feet by 4 feet 6 inches and $1\frac{1}{2}$ inch thick, and six holding-down bolts $2\frac{1}{4}$ inches diameter and 14 feet long.

Girders. The stancheons to be connected together by 60 wrought-iron girders, as shown, all 3 feet 6 inches deep, formed of angle irons $3\frac{1}{2}$ inches by $3\frac{1}{2}$ inches by $\frac{3}{8}$ inch, diagonal bars 4 inches by $\frac{3}{8}$ inch, and top and bottom plates, 8 inches wide and $\frac{3}{8}$ inch thick. On each side of the diagonal bars, where they intersect, to be fixed cast-iron ornamental rosettes, as shown on the drawings.

Diagonal Bracing The whole of the stancheons to be connected by wrought-iron diagonal bracing-rods, $1\frac{3}{4}$ inch diameter, attached at one end to the jaws of the wrought-iron stud bolts fixed to the stancheons, and to the other ends to a strong wrought-iron central ring, each rod being accurately adjusted to the required length by means of screws and double nuts, as shown.

Each stanchion to be further tied on Mr. Paddon's plan, by means of a bar of $2\frac{1}{4}$ inch round iron fixed securely to the top of every alternate stanchion all round, as shown, and adjusting screw-coupling being placed in each tie-rod to bring it into proper tension.

Materials. The bars, rods, angle iron, T-iron, and sheeting to be of the best of their several kinds, and shaped, fitted, and fixed in a thoroughly good and workmanlike manner; all bars of whatever section, where they butt joint, to be machine faced, and the whole of the joining and rivetting performed in such a way that the gasholder may be and remain gas tight.

Painting. The whole of the wrought iron to receive a coat of boiled linseed oil, and the castings a coat of paint, before leaving the contractors works.

Time of Completion. The contractors will complete the gasholder and its appendages, and deliver the same over to the gas company in a good and working state, in 12 months after the order is given.

Terms of Payment. Payment to be made in cash monthly upon the amount of work performed during the preceding month, up to 80 per cent. of the total amount of the contract. The remaining 20 per cent. to be paid in at least three months after completion.

When designing this gasholder, Mr. Livesey intended to have made the roof with a rise of 3 feet in the centre; but, from experiments and calculations subsequently made, he was induced to alter it to 9 feet, so following the usual rule of making the rise a twentieth part of the diameter of the holder. By this alteration, Mr. Livesey is of opinion that the strain on the top curb is reduced to one-third of what it would have been, had the original design been carried out. The holder being completed, Mr. Livesey then decided to ascertain if there existed any possible weakness in the top curb, and for this purpose, in the first place, the exact distance of the curb from the guides was taken at 20 equidistant points, air was then forced in until the holder rose a few inches, carrying all its weight, and on the measurement being again taken, a reduction of the diameter at ten different points was ascertained.

The same process was repeated before and after filling the outer holder with air. The results of diminished diameter, or contraction, were as follows:—

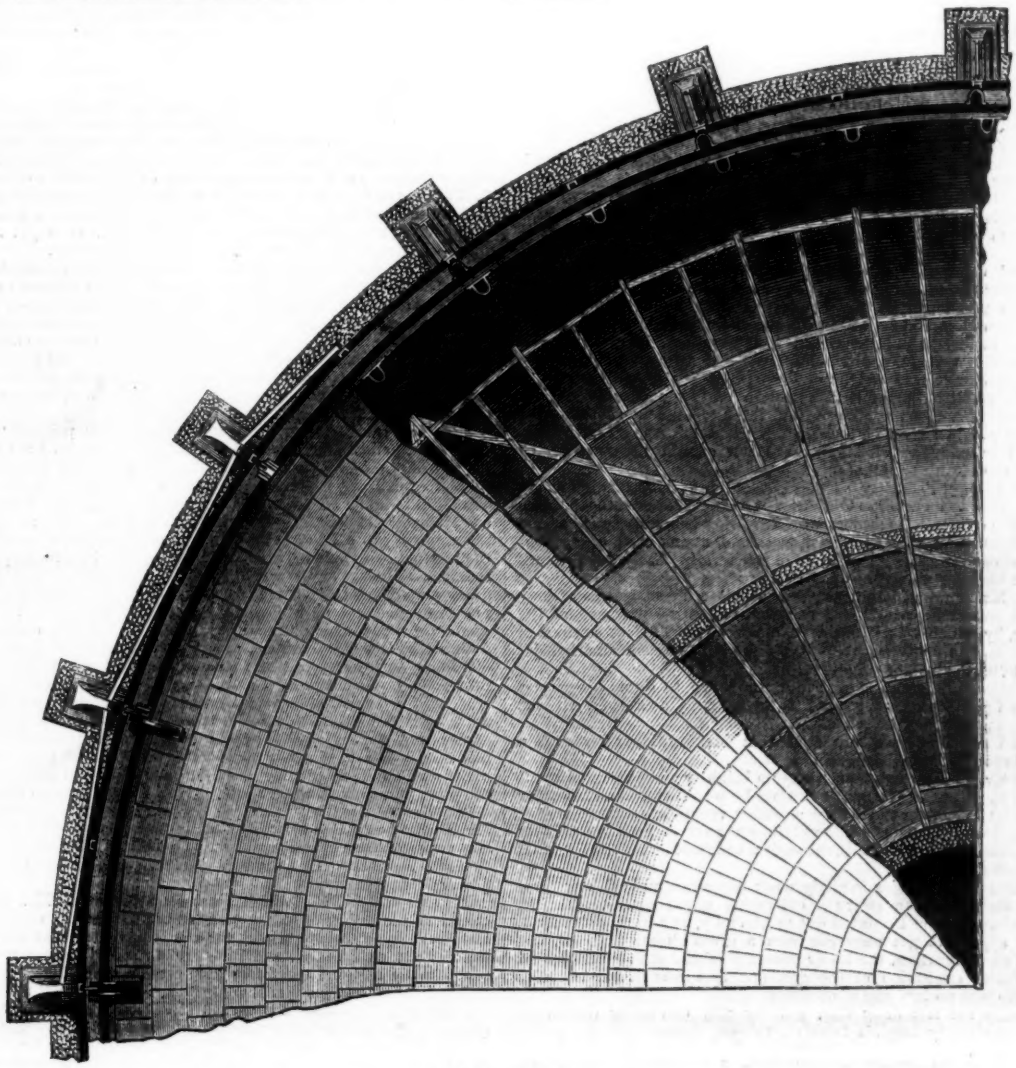
Diameters.	Contraction on lifting Inner Holder.	Further Contraction on lifting Outer Holder.	Total Contraction, with Inner and Outer Holders lifted.	Permanent Contraction, as shown by Measurements taken when landed.
	All expressed in Sixteenths of an Inch.			
No. 1	9	5	14	5
„ 2	11	4	15	5
„ 3	10	4	14	6
„ 4	9	6	15	3
„ 5	8	6	14	1
„ 6	13	7	20	0
„ 7	8	6	14	Out 1
„ 8	10	5	15	1
„ 9	9	5	14	3
„ 10	11	6	17	4
Average	9·8-16ths	5·4	15·2	2·7
Average contraction in decimals of an inch	0·6125	0·3375	0·95	0·169

The very slight variation, as described by Mr. Livesey, which is practically nothing, is difficult of explanation, unless it is to be supposed that, between the points where the measurements were taken, the curb bulged outwards, which would account for the contraction at other points. However, in all cases, the holder has proved to be perfect in all its parts.

In No. 629, vol. xxv., p. 793, of the JOURNAL we gave a description and sectional drawing of the tank, which, it will be remem-

bered, is formed entirely of cement concrete, without the intervention of a single brick or block of stone, and without the aid of the puddle almost universally resorted to for preventing leakage in brick or stone tanks. The novelty and boldness of this undertaking naturally invested it with much interest, and our readers will be glad to learn that Mr. Livesey has kindly promised to give us a full account of the filling of the tank in the course of a short time.

Before concluding our remarks on gasholders, it was intended to present a drawing and specification of the holder erected at the Kennington Lane station of the Phœnix Gas Company, about two years ago, from a design by Mr. C. Woodall, their engineer. This, at present, we are unable to do; but, in the course of a short time, they will appear in a supplementary form to this section of our "Treatise."



(To be continued.)

Correspondence.

GAS EXHAUSTERS AND THE DEPOSIT OF CARBON IN RETORTS.

SIR,—I do not find, either in the patent list or in the pages of your JOURNAL, that the world has been enlightened by any description of "Dunlop's system for the generation of gas in a perfect vacuum."

I am perplexed with the suspicion that the ova from which this nondescript is (expected) to be produced may have become addled in the process of incubation, and that the few "chirps" it has faintly given through the yet unburst shell, are all the signs of life that the interesting bantling which Mr. Dunlop considers quite a "child of his own"—one which he says "I have hitherto reserved in secret, not being sure whether it was a proper child or not"—is ever destined to give.

I fully agree with Mr. Dunlop in his parental doubts, and would console him with the reflection—that he is not the first great man who, after some experience, has had just occasion to throw doubts upon the fancied excellencies of his secretly cherished offspring; and in case the egg, when it does burst, should only stink, I would give him some reasons why he may rest satisfied with the abortion. Because—*vide* address to West of Scotland Gas Managers Association (JOURNAL OF GAS LIGHTING for Sept. 28, 1875, p. 475)—the conception is founded on a mistake. He says: "It appears to me that gas exhaustion is only in its infancy. It is but emerging from its secluded position into a more developed state; but yet far from perfection."

The infant, then, is on the move; it is emerging, it has not left, it is only leaving, its secluded position; but where or in what way has it been secluded? and where is the developed state into which it is merging?

Gas exhaustion has been carried out, by variously constructed machines, for a quarter of a century; there may have been improvements in the exhausters, but not in the exhaustion; for any of them can produce all the exhaustion we seek. Again: "Gas exhaustion, in my opinion, has not been the subject of real, thorough investigation, otherwise *the carbonaceous deposit which presently adheres to the retort would have been totally removed.*"

No foundation is given for the assertion I have put in italics. Is it a prophecy to be fulfilled under the "perfect vacuum" system, or is it founded on experiments not given? *En passant*, I question the theory that pressure inside the retort is the primary cause of deposit of carbon.

I *know* that retorts worked at a low heat produce much less carbon than those worked at a high heat. I also know that retorts properly heated and properly charged, produce much less carbon than those with very hot spots in them and unevenly charged.

I also know that smooth retorts produce less carbon than rough ones. I also know that I frequently do not require to remove carbon from retorts for six months at a time, although they never have been, and I expect never will be, under the "perfect vacuum" system.

The primary cause of both deposit of carbon and stopped pipes is quite other than pressure, either of the apparatus or the atmosphere. I stated my opinions on this question years ago at the Meeting of the British Association of Gas Managers, where the curious can see them. To the opinions then expressed, I adhere, and I only refer to the matter now because it has been, in my opinion, improperly introduced into a discussion with which it has but little to do.

Again: "From the nature of our present apparatus we can only bring down the pressure to that of the atmosphere."

This is, of course, an error. I will not bear upon it, for it has been pointed out by others, and I believe Mr. Dunlop abandons it.

Again: "Were it possible to remove the pressure of the atmosphere altogether, so that there would be a perfect vacuum in the retorts, this deposit of carbonaceous matter would, in my opinion, cease, and thus our work would be facilitated and our revenues increased."

When first I read this paragraph, I charitably thought that Mr. Dunlop did not mean what he said, but when I found, in his answer to "M.," that he really meant to speak of producing gas at a vacuum of 30 feet of water on the retort, I thought it was time to give him a chance of assuming his place among those of us who are allowed to be at large. Accordingly, I wrote a letter, which appeared in your issue of the 2nd of November last.

Mr. Dunlop, however, sticks to his colours well—that is, he moves not, neither does he advance; the propriety of his child he does not now

question, his property in it no one else has. But, unfortunately, that "brighter and stronger sun," for which he piningly longs, shines not one solitary ray to brighten the prospects of the first of "the coming race."

In the letters that Mr. Dunlop has since written, one would have expected to have found some further advance of the "emerging from the secluded position into a more developed state" of this to-be-celebrated perfect vacuum process.

There was considerable cry—in the "West of Scotland"—but there has been *unco'* little wool here in the south, where the sun does sometimes shine. Methinks that a ray from

> "That orb'd maiden,
> With white fire laden,
> Whom mortals call the MOON,"

would have been the more appropriate luminary for Mr. Dunlop to have envoked over the nursery of his weak infant.

No poor child was ever exposed in such naked wretchedness by a hard-hearted father as this one has been. It has been thrust upon a critical and unbelieving world, in all its crude, premature deformity, without a single quality to recommend it, except that when I come into your gas-works you will have no more stopped pipes nor deposit of carbon in your retorts.

One would think that gas managers must labour under some tremendous difficulty, to have to resort to such a desperate remedy.

It is fair to presume that Mr. Dunlop is very much troubled with stopped pipes and carbon deposit in his retorts, and in the benevolence of his heart, and by an infinite stretch of intelligence, he prescribes for the whole world a remedy which he has never tried himself; just as an Alpine doctor, whose neighbours are very much troubled with *goître*, might publish in England a treatise on that unseemly malady, which, fortunately, does not afflict us. I think when a man assumes the position of a public doctor, he should not prescribe untried remedies. Also that the language of his prescription should be clear to the capacity of the meanest apothecary.

Macaulay says, "Propriety of thought and propriety of diction are commonly found together. Obscurity and affectation are the two greatest faults of style. Obscurity of expression generally springs from confusion of ideas, and the same wish to dazzle, at any cost, which produces affectation in the manner of a writer, is likely to produce sophistry in his reasonings."

Just so. Mr. Dunlop, in one sentence of his address, speaks of how valuable it would be, could we remove the entire pressure of the atmosphere, by which we *now* know he means above 30 feet column of water, and in the next sentence but one he recommends a steam-jet exhauster to be the best of all others.

I cannot always take the trouble nor the space to quote his precise words—I can give his meaning much shorter in my own—and without in any degree perverting the sense.

Now could any one have supposed that Mr. Dunlop, after such a recommendation, meant what he said?

Whether Mr. Cleland will come in as "a brighter and a stronger sun" to help him in this controversy, I calculate he would not take his order for a steam-jet exhauster to produce a perfect vacuum.

Again, how would it be possible to form a perfect vacuum in a red-hot retort containing coal that, without such a vacuum, so readily gives off large volumes of gas?

Mr. Dunlop finds it easier to apply weak sarcasms, and ask questions of his opponent, than to answer the objections urged against him. In my first communication I pointed out to him why, at a higher elevation, you might appear to get more gas from a given quantity of coal, was because, at such elevation, the lesser pressure of the atmosphere would permit a greater expansion of the gas, but that in such expansion of volume there was no increase of quantity.

Mr. Dunlop did not deny this, but, by way of casting doubt, he advised me to study Boyle's laws on the expansion of gases under varying pressure.

Knowing that neither Boyle nor any other philosopher would write of *his* laws, I gave him an opportunity of correcting himself in this *lapsus* by telling him that I had studied Nature's laws; but he did not see the joke, for he now asserts that those who are content with Nature's laws work by the rule of thumb, which, of course, he disrespects. Now, what business is it to any one what rule I choose to employ, provided my measurements are correct?

A good workman never quarrels with his tools. It would be more edifying to the readers of the JOURNAL OF GAS LIGHTING if Mr. Dunlop would first answer an opponent; let him have his laugh or his sarcasm afterwards—it may amuse him, it does not hurt me; but the pages of the JOURNAL OF GAS LIGHTING should not imitate, in their contents, the squabbles of a provincial paper.

Mr. Dunlop says: "I am anxious to obtain information, and the opinions of others, on this subject;" and then he proceeds to ask a string of questions.

"What I wish to ask Mr. Anderson to inform me is—Does this less pressure influence the nature of the destructive distillation? Does a ton of coal, when distilled under pressures of, say, equal to, respectively, 27 inches and 31 inches of mercury, give the same quality and the same quantity of gas? Further, does the pressure on the charge of coal, during distillation in the retort, influence the choking of the stand-pipes, and the amount of carbon deposited inside the retort?"

How can he seriously ask such intricate questions of one who he concludes "works by the rule of thumb." Moreover, I cannot permit Mr. Dunlop to conduct his portion of this controversy by asking questions which the reader may take to mean affirmations, but which Mr. Dunlop may repudiate should he find it convenient to do so. And, in addition, such questions are what might be asked of him—not by him.

Mr. Dunlop has affirmed certain propositions—among others, "We should have far more and better gas when the barometer is low, even in a work without an exhauster, than it is possible to get from the same coal when the barometer is high, in a work with the most perfect exhausting power possible." (See p. 613, vol. xxvi.)

This theory he illustrates in a subsequent letter at p. 794, as follows:—"Glasgow at sea-level, and Lanark about 800 feet above it. The latter, consequently, will have a lower barometrical pressure, due to its elevation, equal to about 12 inches of water. Then, supposing that in the Glasgow works they worked level gauge, and in Lanark that the back pressure equalled 12 inches of water, both works would be carbonizing their coal under similar pressures; and as I know that the Lanark works do not use an exhauster, but, at the same time, never have a heavier back pressure than from 6 inches to 8 inches, it follows that the Lanark works must be carbonizing their coal at a pressure less by from 4 inches to 6 inches than they dare do at Glasgow with their perfect exhausting arrangement."

And, again, in the same letter, at p. 793, he writes: "And further, seeing that the variations of pressure due to the position of a gas-work and to the atmospheric changes are as great as, if not greater than, we dare produce with our exhausters, I doubted the advantages popularly claimed for the artificial reduction of the pressure on the coal being carbonized, or, in other words, the utility of exhausters."

Now, it appears to me that the negative of all those propositions is true, namely—1. That the higher the barometer the better the gas (not, however, greater in volume); 2. That whether the gas be made at Lanark or at Glasgow, the quantity, not by volume but by weight, will be so nearly the same as to make no practical or appreciable difference; and, 3. That if the Lanark people were to increase their working pressure to 12 inches, as at Glasgow, they would not get so much gas per ton of coal (carbonized in clay retorts) by 10 per cent. as is got at Glasgow, provided that at Lanark they do not use an exhauster.

Now, here is a direct issue, if Mr. Dunlop choose to accept the affirmative of his own statements; it is one, too, of great interest to the profession, and it may be discussed on purely scientific grounds if Mr. Dunlop can reserve his advice, and parade of book lore, and prayers for sunshine.

Mr. Dunlop must not originate the notion that we are entirely without books in this village. We sometimes get a "*keek* o' ane frae a frien;" we avail ourselves, too, of the circulating library, so we are not perfect heathens who never take a good book in our hands, but we are bashful of parading our accomplishments theranent.

In my last letter, "*presence* of exhauster" is printed "*pressure* of exhauster," and this has misled Mr. Dunlop, at which I am sorry for my bad writing, because once he got into this confusion he became unable to distinguish any difference between a remedy for a disease and an amelioration of it. To set this matter more clear, then, I state that with an exhauster you will have *less* carbon than without one; *ergo*, it ameliorates, but because I do not believe that pressure is the primary cause of the production of carbon, neither can exhaustion be a remedy for its *entire* removal.

My experience has led me to conclude that it is high heat that is the primary cause of both carbon in retorts and stoppages in pipes. By removing the working pressure you ameliorate the carbon in retort disease; by low heats you effectually cure the stopped pipes one.

So long as you can keep naphtha in the tar you have a solvent which prevents all possibility of it stopping up the pipes. In such a case the whole of the tar will be carried by the current of gas into the hydraulic main, or if the heats be very low the ascension-pipe will act as a condenser, and a part of the tar will be lodged in the mouthpiece. The moment, however, that the temperature inside the pipe is sufficiently high to volatilize all the naphtha from that portion of the tar that touches the pipe, you convert the tar into pitch, and you stop up the pipe.

Some coals have a greater tendency to stop up pipes than others, as Mr. Hislop has pointed out. So do some coals produce tar containing less naphtha than others, and I have no doubt that it would be found that it is those coals that produce naphthaless tar that have the greatest power of stopping pipes.

There is one point at which I cannot understand Mr. Dunlop. He questions the utility of exhausters, and is looking in some other direction, in company with a friend, for something else that will be of more utility; yet, as I understand him, and so far as he has revealed himself, it is by removal of atmospheric pressure that better results would be obtained. Perhaps Mr. Dunlop will "condescend" to explain.

I will now "condescend" to ask Mr. Dunlop to reconsider the whole question—"whether it is a proper child or not."

Has atmospheric pressure anything to do with the matter, to us as gas manufacturers?

We know, mark you, that with increased exhaustion we could produce a little more gas; but would it be safe to do so? Would it pay? Would it "facilitate our work, and increase our revenues?"

If we were to use metal retorts we could work with more exhaustion; but, knowing this, we do not do it, because we do not believe in the economy thereof.

We find clay retorts to be the best, but unfortunately they are porous, and the atmosphere presses equally on the outside of the retort as on the pipe from which the gas issues. Is this talk about atmospheric pressure, then, not a bugbear, which, on reflection, we need not be frightened at?

I quite admit—what I believe Mr. Dunlop would endorse, and which is, perhaps, all he means, namely, that the quicker we get the gas out of the retort, and by consequence at the least pressure, the better.

But to what extent is this to be carried, how is it to be done, what is to be the benefit of doing it, and what obstacles—evils—would we meet in our path, that might not more than balance, and render the alteration no improvement?

The benefits that Mr. Dunlop has pointed to are non-production of carbon—no stopped pipes.

Now, assume all this, *cui bono?* If all the carbon now deposited in my retorts were converted into gas, it would not lessen my cost of production ·01 of a penny per 1000 feet. As for stopped pipes, we do not believe in them anywhere, unless with amateurs, who do not understand their business; or by some mere accident, which has no necessary connexion with the arrangements, but which we can trace to carelessness in carrying out our operations.

One sentence only about exhausters. Mr. Dunlop says they are put forth as panaceas for all evils, and he questions their utility.

I do not know to whom Mr. Dunlop refers, as putting them forth as panaceas for all evils. I have said that you cannot work clay retorts economically without them, that your retorts will last longer with than without them, that you can produce 5 to 15 per cent. more gas with than without them, according to the pressure of the apparatus to be removed, and that with them you will have less carbon in the retorts.

If Mr. Dunlop desires to dispute any of those propositions, I shall be glad to give him reasons, accompanied with proofs, in support of them; for I should like to make a convert of him, and bring him to think as I do, that no well-organized gas-work of any magnitude can be without

them. I trust, at some recent date, to have cause to be inspired by that feeling of gratitude which a proper reply from Mr. Dunlop cannot fail to awaken, and hope that he will not consider it an act of "condescension."

New Year's Day, 1876. GEORGE ANDERSON.

WORKING DRAWINGS OF RETORT-SETTINGS.

SIR,—Could you possibly publish a few of the working drawings of retort-settings in the JOURNAL, which you have promised us from time to time? I and several of my brother managers on this side of the Channel have purposely kept back our repairs, until we have an opportunity of inspecting those drawings, and as we are now contemplating our renewals, and shall be reluctantly obliged to proceed with the spring of the year, you will confer a great boon on myself and many others, by giving us the first of these promised drawings in these next issue of the JOURNAL.

A GAS MANAGER.

Ireland, Dec. 31, 1875.

[We propose to commence the publication of the drawings immediately. The first will probably appear next week, and others at as frequent intervals as the demands upon our space will permit.—ED. J. G. L.]

GAS-BURNER TESTINGS AT LEEDS.

SIR,—The second report of gas-burner testings at Leeds, which appeared in your last issue, requires some explanation; otherwise it is misleading, and does injustice to ourselves. The whole of the flat-flame burners reported upon appeared as bat's-wings, with the exception of the "common iron tulips;" but the Nos. 4 and 6 "Bray's" were not bat's-wings, but tulips, giving 15·9 candles, while the "common iron one" is reported to have given only six candles, with the same consumption of gas. The above is an important distinction, as it is so well known in the gas engineering profession that the tulip burner cannot be constructed to give so good a result with common and medium quality gas as the bat's-wing, though the former has other advantages which make it, for most purposes, an indispensable article. Our No. 8 was a bat's-wing, and this and the tulips mentioned above are the usual kind which we make to suit the general (not special) conditions met with in the *use* of gas; and the price is equally adapted for general requirements, being *thousands* per cent. less than the other burners reported upon. As these tests were avowedly made for public information, the above details are surely essential as guides to public judgment. It would also be interesting to have stated what pressure the various flat-flame burners required before their flames were properly spread. If one requires 5-10ths and another 8-10ths, this is a serious matter both to the engineer having the pressure to supply and to those who, as in Leeds, are crying out because they have already too little.

Is a flat-flame burner that is constructed to yield the maximum amount of light that such a burner is capable of yielding, the best for general use? This is an interesting question, to which we have no hesitation in replying "No;" because its best effect is produced by a rather sluggish flame that is so near the smoking point, and that is so susceptible to the movement of the surrounding atmosphere as to produce smoke readily, and frequently cause more expense in clearing ceilings, &c., than would pay the whole gas account. We think that a burner which yields an amount of light something short of the possible maximum, and keeps some reasonable distance away from its extreme liability to smoke, is the best for general, and particularly for domestic use.

Leeds, Jan. 1, 1876. GEORGE BRAY AND CO.

GAS ACCOUNTS.

SIR,—Perhaps some of your readers will kindly inform me (through your JOURNAL) whether it is customary, in making up the revenue account of gas companies, to charge the "cost of labour" for purification of gas with the materials used for the same purpose.

A SECRETARY.

GOVERNORS TO METER LAMPS.

SIR,—In reply to the letter, under above heading, in your issue of last week, Mr. R. W. Brett will learn from the manager, gas-works, Clitheroe, Lancashire, as to the practice I believe adopted there of allowing for the reduced difference of pressure at point of consumption, on those lamps to which meters are fixed, compared with non-meter lamps burning direct from the street-mains without interruption. Such difference of pressure being that required to overcome the friction in working the meters which are fixed to ascertain the average consumption to satisfy the contracting parties; and as meters are fixed at the rate of, say, one to every 12 or every 20 lamps, the duty of the meter is to ascertain what gas has been consumed by these 20 lamps, the lamp the meter is on being one of that number. To take and multiply the volume registered by the meter lamp by 20, would be quite erroneous, so long as no calculation is entered into to compensate for the reduction of pressure at meter lamps caused by the force required to work the meter, which goes to lessen the pressure at point of consumption on this particular lamp, as compared with the full pressure of mains, playing directly on the burner, in the case of the whole remaining 19 lamps.

The average meter system, without doubt, is the best; but would neither be true nor satisfactory, except only when the governors are so regulated as to allow those fixed on meter lamps to pass the same number of feet per hour as the non-meter lamps. To do this while testing meter-lamp governors for the passing of the stated number of feet per hour, the pressure should be reduced by 2-10ths, so that the same number of feet will pass in the given time, under a reduced pressure of 2-10ths—thus: A meter lamp having a governor to pass, say, 4 feet per hour, under a pressure of, say, 16-10ths, a non-meter lamp governor should be tested under a pressure of, say, 18-10ths, to pass 4 four feet per hour, thereby allowing 2-10ths for pressure necessary to work the meter. In most cases this would equalize the meter and non-meter lamps to the same rate of burning per hour.

There are, however, many circumstances under which a gas-meter would require more than 2-10ths to work it, from the fact of its being a delicate instrument, and subject to wear and getting foul; but in no case I consider less than 2-10ths should be allowed on the governors, or the extra rate of consumpt per hour caused by 2-10ths pressure on jets where no governors are used, over and above that registered by the meter lamps per hour.

The gentleman I refer to may also supply a few interesting details as to how long the streets were in darkness until this correct, most just, and only true method of measurement by meter had been agreed to.

Accrington, Dec. 30, 1875. W. KEY.

OUR CHRISTMAS APPEAL.

SIR,—Suffering as I have been now for a considerable time from continued ill-health, it is almost a painful effort to use the pen; yet I cannot refrain from responding to your appeal on behalf of a brother manager and his family, and publicly giving expression to my mingled feelings at the same time—mingled feelings of sympathy, gratitude, sorrow, and shame. *Sympathy* for the poor afflicted ones; "the wife and four children in a state of great privation," and "the husband's health precluding the hope of ultimate recovery." What a picture of suffering and sorrow drawn by your own pen, in the simple statement of facts. *Gratitude* for my own improving health, and the means of ministering to the same; brought into such forcible contrast with the condition of the poor fellow without "hope" of "recovery," and in "great privation." *Sorrow*, that a fellow-labourer was "an hungered" and no one "fed" him, and was "sick" and none went unto him; while we, following the same profession and calling, have comforted ourselves by complacently asking, "Am I my brother's keeper?" *Shame*, that the Association, which was formed at my suggestion in 1864, will not recognize the necessity of providing for such cases—such sad, sorrowful, painful cases as this you have so delicately and touchingly made public. It will be urged, I doubt not, as has been done before, in reply to my appeals to the Association to remove such a cause for grave reflection to be cast upon us as a body, that, on such cases being made public, relief is always given. But let me ask those who thus quiet their consciences, how much of the suffering arising from the "great privation" alone would have been alleviated by earlier relief? and how much the suffering from a state of hopeless recovery has been intensified by the want of support, to say nothing of comfort and sympathy, which it was our duty to give? "Inasmuch as ye did it not to one of the least of these, ye did it not to me."

South Shields, Dec. 31, 1875. W. J. WARNER.

Legal Intelligence.

CHESTERFIELD POLICE COURT.—MONDAY, DEC. 27, 1875.
(*Before the Mayor, Mr. J.* WRIGHT, *and a Bench of Magistrates.*)

CONVICTION OF A LAMPLIGHTER FOR NEGLECTING WORK.

William Higginbottom, Burrows's Row, Brampton, was summoned by the Chesterfield Water-Works and Gaslight Company for neglecting his work on the 18th of December, and thereby causing a loss to the company of 5*s*.

Mr. *Jones*, manager to the company, in the unavoidable absence of their solicitor, appeared to prosecute, and said the object in bringing the case forward was to show the workmen that they could not with impunity neglect their work. On the evening in question his (Mr. Jones's) attention was called to the fact that some of the lamps were not lighted. He went and lighted some himself, and sent a man to light the rest. The case was taken under the Master and Servant Act. He wished to withdraw the claim for damages, as the company only wanted to show the workmen that they were bound by law to fulfil their duties.

The BENCH: If you withdraw your claim for damages you withdraw the case.

Mr. *Jones* said he was quite willing for the bench to assess the amount, as in a case like the present it was very difficult to do so, and he did not wish to be hard on the man.

The Bench decided upon the amount named by the company—viz., 5*s*. and costs.

MACCLESFIELD POLICE COURT.—FRIDAY, DEC. 31, 1875.
(*Before Messrs.* BULLOCK, WADSWORTH, *and* STRINGER.)

CONVICTION FOR NEGLECTING WORK.

John Webster, a stoker employed at the gas-works of the Macclesfield Corporation, was summoned, under the Employers and Workmen's Act, for absenting himself from his work on the 19th and 20th of December, without giving the usual notice.

Mr. *Lyon*, the gas manager, proved the case. The defendant absented himself on the Sunday and Monday previously, without having given any notice, and the sum of 10*s*. was claimed as damages. In reply to the bench, Mr. Lyon said that if two or three of the men employed at the works were to do what defendant had done, it would be a serious thing for the town, which might be left in darkness through their misconduct. The case was merely brought to show the men that they must not absent themselves from their work in contravention of the Act.

Alderman *Stancliffe*, the chairman of the Gas Committee, said the case was brought to teach the defendant and other men that they could not do this sort of thing with impunity. One of the workmen had absented himself entirely, and a warrant had been taken out for his apprehension. Immediately afterwards the defendant committed the offence with which he was charged. He did not wish to press the case, thinking that the defendant's being brought there would serve as a warning to others.

The bench ordered the defendant to pay the 10*s*. claimed and the costs, and expressed a hope that the men would in future conform to the rules, as the town might be thrown into a state of darkness if they were to be allowed to come and go when they pleased.

"A CHRISTMAS APPEAL."—We have much pleasure in acknowledging the receipt of the following sums on behalf of the widow and four children of a gas and water works manager, on whose behalf we ventured to make an appeal in our last number:—

Mr. G. W. Stevenson	£2	2	0
Mr. W. Haywood	2	2	0
Mr. W. B. King	2	2	0
W. T. F.	1	1	0
Mr. E. Goddard	1	1	0
J. U.	0	10	6
Mr. W. J. Warner	2	0	0
Mr. Wedgwood	0	5	0
Mr. G. Livesey	5	0	0
Mr. J. R. Frith	2	2	0
J. C. S.	0	10	6

Further subscriptions will be thankfully received.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

THE REGULATIONS BILL AND THE PROPOSED AMALGAMATIONS.

Mr. G. Livesey has addressed the following letter on the above subjects to a contemporary:—

Sir,—Your articles on the gas question being evidently from the pen of a writer who has a considerable knowledge of the subject, and who, though writing from a consumer's point of view, manifestly endeavours to look impartially at the whole question, I am induced to address you on one or two of the matters that engross attention at the present time.

First, as to the leading feature of the Metropolis Gas Regulations Bill, to be reintroduced to Parliament next session as it left Mr. Forster's committee last June—viz., the principle of the sliding scale of price and dividend, coupled with an initial or standard price, which will completely change the companies from "day-workers" to "piece-workers," in which, while benefiting themselves, they will also benefit their customers. For instance, in the case of some of the companies, a reduction of price, which will give, say, £3000 to the consumers, will entitle these companies, after they have so reduced their price, to appropriate £1000 as an increased dividend among their shareholders; while, with those companies which have the larger capitals, the proportion will be about £2000 to the consumers and £1000 to themselves; and, on the other hand, if the circumstances of 1873 and 1874 return, and coal and iron reach famine or panic prices, the *whole* additional cost of making gas will not be thrown on the consumers, but will be shared, to a certain extent, by the companies.

By the adoption of this principle, the companies will have a strong inducement to adopt all collateral means of increasing their profits; for instance, they may own screw colliers, and if the neighbourhood in which their works are situated permits, they may work up their residual products, when any profit made from these sources would go into the general revenue account, and so enable them to sell their gas cheaper. To this the public could have no objection; while, if the operations resulted in loss, the companies would be the first to find it out, and, seeing that dearer gas would mean lower dividends, the unprofitable operations would be very soon suspended. The objection—and it is a good one—made at present to the companies owning ships and working up residuals is, that it might be an excuse for calling up capital on which they would pay full dividends—to which there could be no objection, so long as these collaterals were worked at a profit; but should they be worked at a loss, the deficiency would be made up to the gas companies out of the profits on the sale of gas.

I am, however, no advocate for the companies undertaking all these additional businesses, for I believe they are managed better by individuals, and would rather see all the efforts and attention of gas companies and their managers concentrated on their proper business of gas-making, buying the raw materials, and selling the residuals in the best markets.

Secondly, as to amalgamations. If the public authorities desire absolute uniformity, perfection in this respect may be attained by a complete amalgamation of all the metropolitan gas companies. Whether this would be an advantage to the consumers is another question. There are those, whose opinion is certainly entitled to respect, who maintain that it would be so at no very distant future, though the amalgamations that have hitherto taken place have not tended in that direction. However, supposing the pending amalgamations to be consummated, the smaller and more prosperous companies will be almost a thing of the past, all being swallowed up, except one on the north and one on the south of the Thames; and with these exceptions, all the other companies are nearly on an equality as to capitals and price of gas; they might, therefore, unite on equal terms without detriment to the interests of the consumers in respect to price.

But supposing complete amalgamation to be effected, what would be the result? The great company would start with differential rates, for it would be manifestly unfair, and surely would not be permitted, to raise the charge for gas of the low-priced districts to the general level. It might be agreed that no further reduction in the cheap districts should take place until the rest had been reduced to their level; then the Amalgamated Company, under the sliding scale, would adopt every legitimate means of adding to its profits. It would very likely obtain some advantage in buying coal, and in selling coke, and tar, and ammonia, or in manufacturing the latter products. It would probably be able to make comprehensive arrangements for the distribution of gas which would be beneficial to London as a whole; but if it adopted the policy of concentrating the manufacture of gas in two or three gigantic establishments away from the consumers of coke, all the above-named advantages, supposing them all to be profitable, would be far more than counterbalanced by the great loss on coke. I hold it to be essential that London should be supplied with gas from a number of moderate-sized works, both on the score of economy and of safety, for I do not think it would be safe to depend on two or three immense establishments at a distance for the supply of gas to London; for should troublous times come, two or three evil-disposed persons could in a very short time deprive London of light. On the whole, it is very doubtful, supposing the Amalgamated Company to have the best possible management, whether, with all its advantages, the consumers would be benefited. In the absence of the sliding scale, I am sure it would be better for the public that they should have at the least two companies, probably more, that they might not be deprived of the benefit of the competition of comparison; and even with the sliding scale it is doubtful whether some half-dozen moderate-sized companies, not so large as to require red-tape management, would not be better for the consumers.

For my part, there is only one thing that makes me desire amalgamation, and that is, that by its means I should probably be relieved from an intolerable burden that deprives me of nearly all enjoyment of life. I refer to the sulphur question, which is practically of no moment whatever, but which gives the gas manager unceasing anxiety. The ordinary business is to most managers a pleasure; but what with the nuisance of using lime on the one hand, leading to constant remonstrances, and in some cases to indictments for nuisance, and the orders of the referees on the other—who, by the way, are certainly not appointed in accordance with the terms of the Act of Parliament—the manager's post is no enviable one; and with all this, as was stated in your last issue, it is doubtful whether any benefit worth the trouble has accrued to the public. Certain it is, so far as the unknown sulphur compounds are concerned, that if ever the local authorities of London take the gas supply into their own hands, the use of lime would be discontinued within the first year, and the sulphur compounds, which cannot be detected except by an elaborate chemical analysis, ignored, as is done by the Municipality of Paris, and by those English corporations which have the supply of gas in their own hands. To this we must ultimately come in London; but in the mean time, let me express the hope that gasmen under the companies may be permitted to pass their last few days or years in peace.

In accordance with my invariable rule, I attach my name, though I do not write in my official capacity.—Yours truly,

GEORGE LIVESEY.

London, Dec. 30, 1875.

GAS LIGHTING AT OUGHTY-BRIDGE.—The Sheffield United Gas Company, by whom the plant, &c., of the defunct Oughty-Bridge Gas Company was purchased from the liquidators in 1874, have just completed the laying of a main from Wadsley for the purpose of relighting the district.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the composition and quality of the metropolitan waters in December, 1875:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	21·37	0·060	0·128	0·002	16·5	4·2
West Middlesex	20·23	0·031	0·147	0·000	16·1	3·8
Southwark and Vauxhall	21·53	0·078	0·149	0·002	16·8	4·2
Chelsea	21·03	0·052	0·136	0·002	16·5	3·8
Lambeth	21·37	0·081	0·115	0·002	16·5	4·2
Other Companies.						
Kent	28·33	0·006	0·345	0·000	21·3	6·4
New River	21·47	0·049	0·131	0·001	16·4	3·8
East London	23·13	0·052	0·181	0·002	17·0	4·0

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was very slightly turbid—namely, in those of the Thames companies, excepting the West Middlesex Company. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Society of Medical Officers of Health, 109,998,771 gallons; and the number of houses supplied was 521,336. This is at the rate of 31·9 gallons per head of the population daily. The last official return from Paris stated that the average daily supply per head of the population was 28·2 gallons; but this includes the water used for the public fountains, and for the ornamental waters in the Bois de Vincennes and the Bois de Boulogne.

HY. LETHEBY, M.B.

AMERICAN GASLIGHT ASSOCIATION.

[Condensed from the Report in the *American Gaslight Journal.*]

The Third Annual Meeting of the Members of this Association was held in the Masonic Temple, New York, on the 20th of October last—General CHARLES ROOME, the President, occupying the chair. There were between 70 and 80 members present.

The PRESIDENT, in his opening address, after referring to the enfeebled state of his health during the past summer, said: We are now assembled for the purpose of deliberating again on matters connected with the interests of the profession in which we are engaged. It is unnecessary for me to remind you of the obligations you are under to those whose interests you represent, and to the public at large. This is an interest embracing the whole country. We meet here from Canada to Florida, from Maine to California. We are here for the purpose of duly deliberating and carefully considering matters which may be presented to us, which are calculated to advance the welfare and usefulness of those institutions over which we preside, and which we represent. Therefore, let us take these matters calmly, considerately, deliberately. We are not here to advance the interests of any one man, or any one company; but we are here to tell each to the other what we know of the business in which we are engaged, which is calculated to advance the general good, and promote harmony between the manufacturer and the consumer. There is nothing in our business, with which I am acquainted, after an experience of 40 years, that we need make a secret of, which all the world may not know. Startling discoveries are not to be expected. Little by little do we advance, and advancing little by little we make sure progress. Therefore should we be calm and self-possessed, and give a due measure of consideration to improvements, or supposed improvements, calling upon each man who rises here to give a reason for that which he asserts, and considering those reasons in the light of truth and conscience; for our business is a business of truth and conscience. If, then, we consider it in that light, our annual gathering will be most valuable to us and to those we represent. Leaving, therefore, the matter in your hands, we will at once proceed to business.

The election of new members was then proceeded with, and 34 gentlemen were proposed and elected.

A report of the Executive Committee was read, recommending that, in consequence of the adoption of the new constitution, the secretary be authorized hereafter to use only the names of individuals as members, in accordance with Article IV., and not the names of companies in their organized capacity. The question of salary for the secretary and treasurer (the two offices being represented by one individual) had been considered by them, and, after a full examination of the financial affairs of the association, they recommended that the sum of 250 dols. be paid to Charles Nettleton, Esq., for his services as secretary and treasurer for the past year.

The report was accepted and adopted.

After the reception of the Finance Committee's statement, the association proceeded to the adoption of resolutions expressive of their regret at the death of Mr. C. L. Everett, the late chairman of the New York Gas Company, and Mr. C. C. Miles, late secretary of the same company, for each of whom the highest respect was entertained.

THE MANUFACTURE OF NAPHTHA GAS.

Mr. NEAL stated that the committee appointed in 1874 to report to the convention on the value of naphtha gas, as compared with coal gas, were not in a position to make a report on the subject, and they asked to be discharged from further duty. One great difficulty to the carrying on of their labours presented itself in the constitution of the committee. It was composed of three members, residing at great distances from each other, and having no opportunity for consultation or conference. He suggested that, if another committee was appointed, it should be composed of members residing near each other, say in the cities of New York and Philadelphia, where they could meet often and get each other's views. It was impossible for the members of the committee to discharge their duty properly when they were separated by such long distances, and could not meet and confer with each other. It would also be better to have upon it at least one, if not more, persons who were engaged in the manufacture of naphtha gas. That was suggested at the last semi-annual meeting, but objections were raised, which he did not think were well founded. Several persons engaged in the manufacture of gas from naphtha, and who were interested in the naphtha process, had stated that they thought there should have been added to the committee one or two naphtha gas men; and if only one had been appointed upon the committee, perhaps they might now have had a report to make. The committee had received many communications from different parties interested in the manufacture of naphtha or petroleum gas, and had been treated very kindly and courteously by them; and he was happy to say that they had found a great many gentlemen who were engaged in that manufacture. It had been intimated that parties interested in the naphtha process went to members of committees or others, and stated to them that "we have a process here which, unless you adopt, will make trouble in your company." This had not been so with this committee. They had been treated

with courtesy, kindness, and cordiality. In many instances they had been invited to visit the works, and had been assured that all their expenses would be paid, and that there should be no expense whatever incurred by the members of the committee in visiting the works. He stated this in deference and out of regard to the feelings of some of the members of the association who represented the naphtha gas interest. For himself he had been prevented by engagements, and the state of the health of his family, from devoting time to the investigation. When the committee were first appointed, they were instructed to report to the convention "*to-morrow*" on the subject—a proof of how little the magnitude of the question was appreciated by the association. He, however, at a subsequent period of the sitting, obtained leave to report in six months. At that meeting Mr. Littlehales, of Canada, moved that the committee be especially requested to investigate and report to the association upon the following points in reference to the naphtha gas process. This motion was seconded by Mr. Cathels, and agreed to—viz.: 1. The cost per 1000 for material. 2. The cost per 1000 for labour. 3. The cost per 1000 for purification. 4. The cost per 1000 for wear and tear of retorts. 5. The cost per 1000 for gas at consumers meters, calculated on gas paid. 6. The rate of wages. 7. Amount of capital required per million feet annual make, to construct works for naphtha, as compared to that of coal. There was, therefore, an immense amount of work laid out for the committee, and he regretted to say that they were not able to answer conclusively one of those questions. Immense works were being built all over the United States and Canada, and, he might say, the whole of America; and it was ascertained by correspondence that naphtha gas was made, either clear or in combination with other materials, all over the United States. He could not state the number of companies where it was used more or less, but there were a great many. If, therefore, the committee were to make a report, and base the comparisons and estimates upon the operations of one company, such a report would be of little value. In order to report intelligently they would have to obtain data from five or six companies. It might be asked why they did not visit these works and obtain the data. It is true it was suggested at the last meeting of the association that the expenses of the committee should be paid to travel. That would not help the matter at all; for though their expenses might be paid, who would pay them for the loss of time in their business? Another difficulty about this investigation was, that they found it utterly impossible to embrace all that ought to be embraced in the report, in order to make it satisfactory. Having made this statement, he did not wish it to be understood that he considered there was no need for further investigation. On the contrary, he thought it worthy of full inquiry, and he trusted the association would prosecute their researches; for if a process of manufacturing gas from naphtha, or anything else, could be discovered, which was cheaper and better than processes now in use, every one would be benefitted.

Mr. PRICE having expressed regret at the absence of a report on the subject, moved that the committee be discharged from further duties.

The motion was put and carried.

ELECTION OF OFFICERS.

The election of officers was then proceeded with, and the following appointments were made:—

President—General Charles Roome, New York.
Vice-Presidents—W. H. Price, Ohio; George B. Neal, Massachusetts; Professor J. L. Smith, Kentucky.
Secretary and Treasurer—Charles Nettleton, New York.
Finance Committee—John S. Chambers, New Jersey; S. P. Harbison, Connecticut; George A. Mellhenney, Washington, D. C.
Executive Committee—W. H. Denniston, Pennsylvania; T. Littlehales, Canada; General A. Hickenlooper, Ohio; Henry Cartwright, Pennsylvania; William Henry White, New York; Henry Stacey, Indiana.

At the afternoon sitting the SECRETARY read the following paper:—

ON THE USE OF PETROLEUM AND ITS PRODUCTS IN THE MANUFACTURE OF ILLUMINATING GAS.

By Mr. J. DESHA PATTON, of Pennsylvania.

My experience with petroleum in gas making has been almost entirely with that form or grade known as naphtha or benzine; nearly all the other forms —except residuum—I have tried experimentally, with one general result—viz., that the heavier the oil used the lower would be the candle power, and the higher the yield in bulk, and the greater would be the heat required to convert it.

Taking, then, that form with which I am best acquainted—commercial benzine—I will state as the results to be obtained from it, a yield averaging about 70 feet of gas per gallon of oil, and about 70 candles as the average standard of the light. This is what may be expected in constant running day after day. By no means have I ever been able to exceed 100 feet per gallon; and I can only obtain that by destroying a large part of the illuminating power of the gas. Nor have I ever been able to manufacture a less quantity than 56 feet per gallon, and that only by using so low heats, that a considerable portion of the oil would be unconverted. A yield of 70 feet of 80-candle gas, or 80 feet of 70-candle gas, is the highest result in light and value I have ever obtained or seen from a gallon of ordinary benzine; and I claim that no materially higher yield is possible, because either 70 feet of 80-candle gas or 80 feet of 70-candle gas weighs just about the same as the gallon of oil.

The amount of fuel required for the conversion of a barrel of oil is about 7½ bushels of coke—in practice—so that the cost of 3000 feet of oil gas, in material, is that of one barrel of oil and 7½ bushels of coke.

The gas thus made stands all tests that coal gas will, and actually contains less condensable matter than good coal gas does. It carries in the pipes and remains in the holder with less deterioration, and reaches the burner in just as good condition as the most orthodox coal gas.

The retorts I have been using last from three to nine months—say six months average—and cost to renew about 90 dols. per bench, or about 50 cents per day, making 6000 feet in 24 hours. This adds 8 cents per 1000 to the cost of the gas for retorts.

Present average prices in Pennsylvania for oil and coke are about 6 cents. per gallon, and 10 cents. per bushel, respectively, so that we have—

For 42 gallons of oil	2·52 dols.
For 7½ bushels of coke.	·75 „
Renewals of retorts	·25 „
Making for 3000 feet of gas	3·52 dols.

or 1·1733 dol. per 1000, exclusive of labour and interest, as the cost of 70-candle gas.

The labour required may be safely stated at less than one-half of what would be required for an equivalent amount of coal gas; and the cost of coal gas, in material and repairs in Pennsylvania, would be in the neighbourhood of 90 cents per 1000. Leaving, in round numbers, the cost of oil gas 25 per cent. greater than that of coal gas in materials, which would be, in great part, compensated by the saving in labour; but would still leave a balance of some cents per 1000 against the oil gas. A difference that, in the case of new works, would be much more than made up in the diminished cost of construction.

The use of this gas as I have used it in new works, where a price proportionate to its actual value could be obtained, is easy; and the consequence is that a good and cheap light can in such cases be profitably furnished by it. But the point of interest to established companies is—How can there be any economy to them in the use of oil gas? Even if it could be made and furnished into their holders for nothing, it would involve them in financial loss if they were (as public opinion demands) to sell the 70-candle gas at the price of 14 or 16 candle gas, because their consumers would be obliged to use small burners, and the total consumption, in money value, would amount to less than present profits; and, therefore, no matter how cheaply 70-candle gas can be made, the established companies cannot use it alone, without a change in the standard of price that would be difficult to make.

To quote from my pamphlet published early in the present season:—

From my point of view your consideration of this matter involves not so much the advancement of your position as the holding of it.

The position of all large and well-managed gas companies is financially as good as they can hope to make it. You cannot well increase your per centage of profits without eliciting public clamour and opposition, and the advantage which you can expect from improved methods of gas-making lies in the line of such improvements as will enable you to furnish a cheaper light to your consumers.

The difference in favour of oil gas, as compared with coal gas, is owing principally to its greater richness, and if you can render available to yourselves and to your consumers this greater richness, you will receive all the benefits that the use of oil can give you.

How to do this to the best advantage is therefore the question for you to solve.

I will state first: That you cannot, with continuous success, make petroleum gas in the same retorts, and at the same time, with coal gas or any other gas. Even the different grades of petroleum require different degrees and different quantities of heat to convert them, and would differ still more from other materials in that respect.

Second: That petroleum and coal are the only materials in common use that are capable of yielding illuminating gas, and I consider the manufacture of any non-illuminating or diluent element a temporary subterfuge only, and nearly or quite as costly as a low grade of coal gas.

My experience and observation satisfy me fully that these statements are correct, and if so they are insurmountable objections to at least three-fourths of the so-called "petroleum gas" schemes, and leave none to be considered except those that make gas from petroleum alone, and use it either pure or mixed with coal gas.

This reduces the consideration of the matter, so far as the established gas companies are concerned, to a single point:—Can it be used profitably in connexion with coal gas?

My experience in this matter shows that it can; that the use of 8 or 10 per cent. of oil gas, for enriching, will result in a saving equal to the difference between the prices of regular gas coal and common bituminous coal, or somewhere about 20 cents per 1000. The actual results in one case, where Westmoreland coal at 6·90 dols. had previously been used, in iron retorts, without an exhauster, gave a yield of 4½ feet to the pound, averaging about 15 candles in quality. The introduction of oil was followed by the use of Morrisdale coal, at 4·61 dols., without any noticeable difference in quantity of the yield from the coal alone; and the addition of 8 per cent. of oil gas produced a mixed gas of 17 candles, with the financial result of saving very nearly the entire difference in the price of coal, or about 20 cents per 1000 feet on the entire yield. I understand that the difference in the price of gas coal and ordinary bituminous coal in New York is not so great as in the instance above stated.

In such case about the same general result may be obtained by using Westmoreland coal, and running it as low as possible, without regard to the candle power, or, in other words, work out of your coal all the gas you can get, and enrich it up to whatever standard you desire with gas—not vapour or imitation of gas—made from petroleum. In this way you can get 13,000 feet of good 16-candle gas out of a ton of coal, and 16 gallons of oil; or, 1 ton of coal and 32 gallons of oil would give you 14,000 feet of 20-candle gas; or, again, 1 ton of coal and 1 barrel of oil would yield 15,000 feet of 24-candle gas. Thus, the coal gas companies can mix a small portion of oil with their coal gas to their own advantage, and without loss to their consumers; and they can mix additional quantities of oil gas with their coal gas to the advantage of their consumers, and without loss to themselves.

So long as it is considered a financial necessity to use bulk as a base, or as an element of value to illuminating gas, that variety of bulk which, all things considered, is the cheapest and least injurious to light, to meters, and to public health is the one that is needed; and it is yet to be shown that, in economy or desirability, any cheap gas yet produced is capable of taking the place of coal gas. If a strictly or nearly pure hydrogen gas could be made, stored, and delivered at about one-half the price of 8-candle coal gas, or one-third the price of 16-candle coal gas, it might be made a desirable base; but until this can be done, I believe that the saving to be expected from the use of oil gas in established works is confined to the figures I have given, unless they feel sufficient confidence in their consumers to say to them: "We are going to furnish you with 70-candle gas, which at 10 dols. per 1000 is cheaper to you than the gas we have previously furnished at 3 dols."

In closing, I wish it understood that the figures I have given are those of actual experience in continued working, and not of a series of experiments; and that I am addressing only those who will recognize in my statements a desire to contribute to the general fund of information my quota of experience with exact truthfulness. And if it seems to any one here that I have not been explicit enough in statements of detail, or have not met some of the many erroneous objections that have been made to oil gas, it should be remembered that there are many causes of bitterness that could easily be awakened, and probably would be, had I undertaken to explain any particular mode of oil gas making, or to relieve the oil gas system generally from the stigmas cast upon it by the faults of its advocates.

In the discussion which followed the reading of the paper,

Mr. PATTON, in reply to inquiries, said, when speaking of a ton of coal, he meant 2240 lbs.; that the oil was brought in contact with the red-hot surface by being dropped into the retorts, and that, under those circumstances, he found that a portion of the oil so burned was converted into solid carbon, and, at a lower heat, became condensed. The quality of the gas was ascertained by photometric test, the burner employed being a 1-foot burner, and the results were compared with the amount of gas that ought to be allowed under the regular test. The tests had also been made with a 2½-inch burner—an open tube, or ordinary Argand burner. With the latter, 1 foot of gas would give the light of 14 candles, whereas coal gas, under the circumstances, would have required a consumption of 5 feet for the same illuminating power. Having ascertained that 1 foot gave 14 candles, it was estimated that, with the standard of 5 feet consumption, it would make 70 candles. This gas, for which 10 dols. per 1000 cubic feet was charged, was considered, by persons using it at the rate of 1 foot per hour, to be equivalent to a 16-candle gas consumed in a 5 or 6 foot burner, and sold at the rate of 3 dols. He was not prepared to say how leakage would affect the production of this gas; he tried to have as little leakage as possible.

Mr. PRICE said Mr. Patton had spoken of the advantage of using gas made from petroleum as an enriching material for gas made from poor coal. Now, he held it to be almost invariably true, that a poor coal, with certain qualities about it which rendered it unfit to be used, was not worth anything in the manufacture of gas. And he could hardly conceive of a coal, good enough to make gas, which was not rich enough to produce the proper amount of light. The only coals fit to make gas with were those which, with the addition of a little cannel, made as good gas as any community need have. So that, if any one set up petroleum gas-works with the expectation of buying cheap coal to be used in connexion with them, he would be disappointed.

Mr. OLNEY said he had used English coal, which produced 3½ or 4 feet per pound. In 1852 he used a coal that would produce, on an average, 4 feet, and made a gas which was then considered equal to 16 candles; and he had to employ 25 per cent. of cannel, which, at the present price of cannel, would

make the gas a very expensive article. But he found that, by employing a small proportion of petroleum, and adding it to the gas produced from such coals, it was equal to the gas obtained from the best coals they had, while the cost was very much less than by using cannel. With regard to the storeage of coal, he remarked that coal depreciated very much in value if stored for a long period of time. It should be kept in perfect darkness. Coal that was exposed required a much larger proportion of enriching material, either from petroleum or cannel, than coal which had not been so exposed. The question of petroleum was one that was a good deal talked about. At the present time petroleum was in such a shape that it could be used in a way that worked instantly, and produced better results.

The PRESIDENT said he should like to hear the experience of some member who had been using a cheap or inferior grade of coal like Lingan.

Mr. NEAL said he used one-third Lingan coal, and mixed it with Westmoreland or Youghiogheny coal; and, so far as his experience went, he thought Mr. Patton made a mistake in thinking it was very poor. It had a very good illuminating power, perhaps 13 or 14 candles. When used with Westmoreland and other first-class coals it produced very good results. He heard very good reports of its use from the Manchester Gas Company, and that was the reason why he began to use it. He thought it made a very good diluent for coal gas, but for naphtha or petroleum gas he did not think it was pure enough. He knew there were some coals that were very cheap; but when they came to be used there was a great deal of sulphur in them, and other impurities that made them less valuable for gas-making. The president of the Lexington Gas Company informed him that they were now using the Butler process—viz., clear petroleum, and that they charged 12 dols. per 1000 where then gas was very good and rich. Gas in that place had been sold before that process was introduced at 3 dols., and it cost the consumer, for the same given amount of gas, just about the same at this price as the Charlestown coal gas at 3 dols. The Manchester and Concord were the only companies using Lingan coal to any great extent. The Manchester Company used it in the proportion of 5000 tons to 2000 tons of Penn. They use it chiefly in winter. Their result was 9090 feet to the ton of 14 or 15 candles, which he thought was the result generally obtained in the use of Lingan coal.

Mr. EDGERTON said the question in his mind was whether it was necessary or desirable to dilute oil gas with coal gas. In Scotland, where 30 to 32 candle gas was made, they might just as well consider the propriety of using Newcastle coal, and bring the standard down to 15 to 16 candles, as for the members of the association to consider the propriety of using petroleum gas only as an enricher of coal gas, instead of adopting the standard which the material naturally yielded. The results obtained from practical operations and experience showed conclusively that the proper method of using petroleum was to make the gas pure, or exclusively of oil, and to sell it at a price proportioned to its illuminating power. The great economical value of oil gas turned on this point. Prices were actually obtained all over the country ranging from 10 to 35 dols. per 1000 cubic feet—that is, for 60 to 80 candle gas; consequently, gas could be manufactured of high illuminating power, and by getting pay in proportion to its illuminating value, a far greater net revenue could be secured to the companies than by any other method. Taking the figures given by Mr. Patton, they must arrive at the same conclusion. In regard to the dilution of rich gases, at one time, in the old country, it was proposed to use "water gas" (hydrogen, carbonic oxide, and carbonic acid), and the question was very thoroughly discussed, *pro* and *con.*, by Professor Frankland and Dr. Fife; and he (Mr. Egerton) would read an extract showing on what grounds water gas received a *quietus:*—

To determine in what ratio the illuminating power of the gases obtained from both oil and coal was reduced by diluting them in various proportions with hydrogen, we instituted a series of experiments, the results of which are of importance, inasmuch as they indicate not only that the mixture is deteriorated, but that the same quantity of carbonaceous matter yields less light the more largely it is diluted with hydrogen.

In the first experiment we took a portion of coal gas, of the specific gravity, ·67, which we found to consume at the rate of 4400 cubic inches per hour, and yielded the light of 11 candles, being 400 cubic inches per hour for the light of one candle. This gas being diluted with a fourth part of its bulk of pure hydrogen, acquired a specific gravity ·55, and wasted away at the rate of 6545 cubic inches per hour, yielding the light of 10 candles. As a fifth part of the compound was hydrogen, the remaining four-fifths, amounting to 5236 cubic inches, was the quantity of coal gas, which, in its diluted state, gave the light of 10 candles for one hour, so that 524 cubic inches of coal gas were requisite to give the light of one candle for the same time. But, in its unmixed state, 400 cubic inches were sufficient to give the light of one candle for one hour; and, consequently, the deterioration occasioned by the dilution was in the ratio of 524 to 400, being 24 per cent. Further results showed—" for one-third hydrogen, a deterioration of 27 per cent.; for one-half hydrogen, 30 per cent."

The whole question, then, of the propriety of diluting rich gases depended upon the fact whether, after dilution, the total illuminating effect was as great as before. Using diluents would necessarily increase the size of the holder, mains, and all the apparatus, and would consequently increase the cost of manufacture in every particular. Therefore, if it could be proved that a rich gas could be sold for a sum proportioned to its illuminating power, the whole question was more favourably solved than by resorting to diluents to maintain the ordinary 15 to 16 candle standard. Finally, then, as between coal gas and oil gas, taking the same illuminating quality as a basis, what were the comparative merits? He would give the results, extending over a period of three years in a large works* which showed on a manufacture of 400,000 to 600,000 cubic feet daily of the oil gas that, diluted with air to the extent of 19 to 20 per cent., 42-candle gas, was obtained, petroleum naphtha used averaging somewhat less than ten gallons per 1000 cubic feet; and 70,000 cubic feet per day per stoker was the labour average. Benches which had been in use three years without renewal yielded 120,000 cubic feet per day per bench of 12 × 20, six retorts. These results showed a vast superiority over anything obtainable from coal. He was sorry to see the Naphtha Committee failed to make a report. It seemed to him they might easily have gathered the facts, either by visiting the works or corresponding with those who were successfully manufacturing the gas. They might easily have ascertained the yield and the labour employed, the main items, or have prepared a letter of inquiry, in such terms as they saw proper, and sent it to the managers throughout the country, where the oil was well known to be in successful operation. They did not seem animated with a very strong desire to find out anything about the matter, and it did not seem to him that the reason they had given through their chairman by any means released them from the responsibility of not making a report.

Mr. NEAL said the committee were very anxious to find out the cost of the gas delivered to the consumer, but they did not succeed in doing so.

Mr. EDGERTON said any company would have shown the material results obtained by them. They might not be willing to go into financial details of their operations, which were, in one sense, the exclusive property of the company. But he did not think the committee would have found any manufacturer of oil gas who would not gladly give them his material results, and all the information necessary to form an intelligent opinion in regard to the production of oil gas, the quality and cost of production. The cost of distribution had nothing to do with the question. He (Mr. Edgerton) accompanied a gentleman through a number of works using oil in various ways, and the running details of the work were laid open to his investigation, all the results, in fact, that he cared to examine. He wished here to say a few words about a considerable difference in yield and quality, reported by different authorities. The discrepancy was more considerable in quality than quantity. It was stated very clearly in Mr. Patton's paper that different grades of oil required different heats, meaning by grades, gravities—that is, to get a favourable result from naphtha a certain heat was required, and from kerosene a higher heat, &c. Carrying out this law, the most favourable results were obtained by the most complete fractionation of the oil, and hence it was, in his opinion, that the practically most complete fractionation of the material, petroleum naphtha, gave about 33 per cent. greater results. In looking over a report made to him five years ago by Professor Würtz, he found the experiments then quoted gave about the same results, barring the difference just mentioned, as were now obtained on the lower scale, where the fractionation was completely carried out. The labour required was a great item of saving. In coal gas-works 27,000 to 28,000 cubic feet per day per stoker was a large result. In an experience extending over several years, he found the make per man of oil gas was about 70,000 cubic feet. Oil gas 70,000 cubic feet of 42-candle gas per stoker, coal gas 27,000 cubic feet of 13 to 15 candle gas, was, certainly, a very disproportionate figure for labour. He would here again call attention to the fact that these were no experimental or estimated results, but hard indubitable facts, and not like those of certain coal gas advocates who had dabbled in oil a little. Their experiments were generally on a trifling scale, or abounded in theories. On the other hand, the results reported were obtained from the successful manufacture of oil gas at 30 different works, some on a very extensive scale, producing over 500 million cubic feet annually of oil gas, equal, say, to 2,000 million cubic feet of coal gas. His deductions were founded upon the successful manufacture of this considerable amount of gas annually, and consequently could not be called in question for want of practical basis.

The PRESIDENT announced that the discussion for the day must now close. The secretary desired to read some figures in regard to the question under discussion—the manufacture of gas from petroleum.

The SECRETARY read the following statement of gas made by the Citizens Gas Company of Poughkeepsie, New York, during the month of September, 1875, and the materials used:—

Anthracite coals, stove and grate size	36·1973 tons.
Bituminous coal	3·458 „
Crude petroleum	4,333 gallons.
Coal tar for fuel	55 barrels.
Gas made	1,164,700 cubic feet.
By jet photometer	17·10 candle power.

The labour was performed by two men by day and two by night—four men in all. The following figures he said were the result of practical work in the city of Utica, under what was known as Lowe's patent,* recently introduced, and now in successful operation in that city. It was expected that Mr. Fish would be present to answer any questions that would be asked him respecting it, but he had not yet arrived. He would now read the figures.

"There was used at the works of the Utica Company, New York, in the manufacture of gas under the Lowe process, during the month of September, 1875—

Anthracite coal, stove size	92·1955 tons.
Crude petroleum	9477 gallons.
Gas made	3,050,600 cubic feet.
By jet photometer	20 candle power.

The labour was performed by two men by day and two by night. The first of these results was obtained under the Gwynne-Harris process, and the last under Lowe's patent."

The sitting was then closed.

In the evening Professor Chandler, of Columbia College, delivered a lecture to the members of the association, an abstract of which will appear in due course.

(To be continued.)

* The Mutual, of New York.

THE COMBUSTION OF COAL GAS, AND THE THEORY AND STRUCTURE OF FLAMES.

At the Meeting of the Members of the Society for the Promotion of Scientific Industry, held at Manchester on Tuesday, Dec. 14—Mr. E. T. BELLHOUSE in the chair—a paper on the above subject was read by Mr. JOHN WALLACE, of Newcastle-on-Tyne, of which the following is a full abstract. After a short introduction, explanatory of the mode of manufacture and distribution of gas, the writer proceeded:—

Professor Bunsen discovered, that by mixing air with gas before burning it, a much smaller and hotter flame was obtained than before; and since he gave the world his discovery, hundreds of modifications of it have been made and applied, with more or less success, to an infinite number of purposes. The effect of mixing air with the gas is best shown by experiment.

I light the gas issuing from a pipe 1 inch in diameter, and you see a long straggling smoky flame. The gas will not burn alone, and as it is only by contact with the atmosphere that combustion can be maintained, it spreads itself out so as to have a large surface. Inside, the flame is hollow for a considerable distance, and if a vessel of water or other cool substance were placed over it, a coating of soot would soon be deposited; but the moment I remove my hand from the air orifices at the base of the tube, the air rushes in, and the flame instantly contracts to one-tenth of its original size; and as all the heat the big flame gave off is now produced by the small one, the temperature of the flame is much higher. This flame deposits no soot, but, on the contrary, will burn it away from a coated surface.

Returning to the smoky flame, I coat a piece of tin plate with soot, which has suddenly been changed from the invisible and gaseous form into a wonderfully fine black powder; and now admitting the air, the flame shrinks and intensifies; the carbon is again transformed, and is now carbonic acid gas.

Bunsen, or atmospheric burners, no matter what their form is, all possess certain essential parts in common. There is a gas-jet orifice, and in close proximity one or more air openings. There is a chamber where the gas and air mix, and there is the outlet where the mixture burns.

Here is the simplest known form of Bunsen's burner. It consists of a straight upright tube with a gas-jet orifice at the bottom, and holes at each side of the jet through which air is drawn by the inductive force of the gas. On removing the tube and lighting the jet, the gas burns in a long pencil from the orifice, but when the tube or mixing chamber is put on, the gas must burn at the top.

If the gas should light inside, then combustion is interfered with, and partially burnt gas begins to escape, producing the sickening smell which has brought the Bunsen burner so often into disrepute. The Patent Office bears witness to scores of inventions devised to obviate this defect, and it is my purpose to exhibit to you several forms of apparatus designed to avoid this most inconvenient tendency.

I shall now direct your attention to the appearance of the flame, as it is in all cases an unfailing index of the value of the burner for practical purposes.

Not only must the proper proportion of air be mixed with the gas, but it must be mixed intimately; otherwise the flame will be irregular, produce a roaring noise, and be liable to light within on a slight change of pressure. The roaring appears to be caused by certain parts of the column of gas and air having an explosive proportion, while other parts have a less quantity of air. The explosions are so minute and so rapid as sometimes to produce a musical note. This may be cured in a common burner by lengthening the tube, and by other methods.

* We shall give a description of this process in an early number.—ED. J. G. L.

Here is a burner one inch in diameter, with a flame which shows all the peculiarities of good combustion. The flame has a hollow space within it, represented by a most brilliant emerald green cone, resting on the tube. Above this is a clear amber-coloured flame. The cone has a sparkling irregular surface, and the flame shows a strong disposition to light down, indicating an imperfect mixture of air and gas in the tube. To render the admixture more complete, a piece of sheet metal, folded so as to divide the tube into several flat vertical passages, is inserted. The flame is now quite steady, although the bottom of the tube is full open, and the gas may be turned up or down, within wide limits, with perfect safety.

In this case the surfaces against which the gas passes give it a rolling or eddying movement, which thoroughly mixes the gas and air before they reach the flame. A mass of loosely-twisted wire will produce nearly the same effect, but it reduces too much the velocity of the gas.

Another and more complete method may be employed to adjust the amount of air, as exemplified in the Cam burner.

At the base of the tube is a gas-cock, having an eccentric fixed on the plug or key, which lifts the air-slide in proportion to the amount of gas passing. The curves on the eccentric are so made that on one side the maximum amount of air is admitted, producing an oxidising flame; the other side admits just enough of air to produce a carbonic oxide or deoxidising flame. By quickly reversing the cock, the air-slide is closed while pure gas burns at the top of the tube. In addition to this, the burner-tube is hinged so as to incline to any angle, making, on the whole, a very useful laboratory burner.

To illustrate the intensity of the heat of the flame, I shall expose to it a piece of copper wire, one-eighth of an inch thick. It becomes rapidly red hot, then a pale golden colour, and now it has fallen in molten drops into the vessel of water placed below the flame. Copper is estimated to melt at 2245° Fahr.

It is not always convenient to use a burner of this description; because, if the pressure were suddenly to be lowered independent of the cock and eccentric, it would strike down and cause the usual nuisance.

In order to have a burner which is absolutely safe and reliable under all variations of pressure or quality of gas, another burner must be used, of a class represented by the Tangent burner, which makes the most perfect of all flames.

It consists of a circular chamber, into which the jet of gas enters at a tangent, drawing with it the gas necessary for preadmixture. The compound eddies round the chamber escaping finally at the tube a perfect mixture. A diaphragm of wire gauze below the tube prevents the flame from getting into the chamber, and a covering of the same material protects the jet orifice of the gas.

This burner may be made of various sizes, of which I have here an example, with 12 flames.

It it now time to inquire how much air is mixed with the gas previous to combustion. The following tables contain the desired information. They were made upon Newcastle gas, which combines with about 6½ volumes of air during combustion, and they show how much air may safely be mixed previous to combustion, for a burner of a given size.

Experiments on the proportion of gas and air, mixed previous to combustion, in Wallace's burner:—

TABLE I.—*Pressure of Gas and Air, 6-10ths of an Inch.*

Experiments.	Height of Inner Cone.	Height of Outer Flame.	Volume of Gas per Hour.	Volume of Air per Hour.
No. 1 .	0·29 inch ..	2·75 inches ..	6·00 cubic ft. ..	8·32 cubic ft.
„ 2 .	1·00 „ ..	2·55 „ ..	6·00 „ ..	6·00 „
„ 3 .	1·55* „ ..	3·30 „ ..	5·82 „ ..	3·66 „

TABLE II.—*Pressure of Gas and Air, 15-10ths of an Inch.*

No. 4 .	0·55 inches ..	3·30 inches ..	8·84 cubic ft. ..	12·72 „
„ 5 .	1·00 „ ..	3·30 „ ..	8·88 „ ..	10·92 „
„ 6 .	2·40* „ ..	4·30 „ ..	9·00 „ ..	6·96 „

* Cone almost imperceptible, with short white tail.

The burner-tube used for these experiments was 7-16ths of an inch, inside diameter; the consumption of gas was maintained as nearly uniform as possible, and the tables indicate the changes in the appearance of the flame as the preadmixture of the air varied.

The result showed that 1½ volume of air was the most that could be mixed with the gas previous to combustion; and if less than 65 per cent. of air were mixed, the flame began to burn imperfectly and deposit soot.

There must always exist a certain proportion between the diameter of a burner-tube, the quantity of gas passing through it, and the quantity of air mixed with the gas.

A well-made Bunsen burner will be equally efficient with gas at all pressures from three-eighths up to any number of feet on a water column, and it is difficult to say how much gas may be burned through one tube.

We have already observed that as the pre-admixture of air increases, the flame becomes smaller and more intense.

Bearing in mind, then, that the nearer a substance to be heated is placed to the source of heat, the more rapidly the heat passes into it, we find that a vessel of water may be placed nearer the centre of the flame without interfering with combustion. Besides, there is less risk of the flame being fouled in its own products when the amount of air it takes up, while burning, is reduced to a minimum.

In the following table are the results of three trials made with the illuminating burner against the Bunsen burner. A vessel of tin-plate containing one pint of water was placed over an illuminating burner, of the bat's-wing form, at a height chosen out of three trials as the best position. The same vessel and quantity of water were placed over the Bunsen burner with the same precautions:—

TABLE III.—*Gas burning at the rate of 4·5 Cubic Feet per Hour.*

Experiments.	First. Min.	Sec.	Second. Min.	Sec.	Third. Min.	Sec.	Average. Min.	Sec.
Bat's-wing . . .	12	43 ..	12	45 ..	12	48 ..	12	45
Bunsen	9	32 ..	9	32 ..	9	33 ..	9	32

Showing an advantage of 3 min. 13 sec., or 25 per cent., in favour of the Bunsen burner.

As the diameter of the Bunsen burner is increased, it becomes more and more difficult to obtain a good and steady flame. Increase of length gives the air and gas more time to mix and produce a regular flame; but the slightest disturbance causes it to strike down. The experiments with the folded plate and twisted wire as slight obstructions made a certain improvement, but could not be called a complete remedy. The rose top is the best known appliance, but when made of a large size the combustion of the interior of the flame becomes imperfect, and, after all, it will not bear turning low without striking down. Another necessary condition also presents itself increasing the difficulty of obtaining a good large flame. The proportion of air mixed previous to combustion must be greatly augmented, because the surface of the flame (which takes up the remainder of the air to render combustion complete) does not increase in the same ratio as the volume of the flame.

If the flame be long and straggling, although giving off no unburnt products, it will almost certainly deposit soot when applied to the cold surface of a vessel of water; it therefore becomes a matter of the greatest importance that the right admixture be obtained, and that the burner be of a form that is free from the risk of striking back.

To meet this difficulty the perforated cap has been devised, which, by reversing the usual mode of construction, gives most extraordinary results. Instead of regulating the pre-admixture of air from below by partially closing the air orifices, it is done at the top by back pressure.

A cap of perforated metallic plate is fitted over the top of the burner tube, and made to slide up or down so as to adjust the number of openings through which the air and gas are to escape into the flame. The cap offers more or less impediment to the upward passage of the gas, and thus controls and regulates its power of drawing in air at the bottom. This burner has been found to burn every kind of coal gas with equal facility.

When lit and adjusted to the maximum amount of air, the cap is studded with brilliant green beads forming the base of the flame, each bead corresponding with one of the perforations, while above them you see a flame which is solid to the centre, and without that hollow space which has heretofore been considered a peculiar feature to all-round flames.

A piece of fine wire put across the flame close to the metal is incandescent along the whole length enveloped in the flame coming from a tube 2 inches in diameter, and consuming 40 feet of gas per hour. When the air opening is partly closed, a hollow conical space immediately appears in the flame, and the wire cools to blackness. On opening the passage the wire becomes at once incandescent, and the flame is solid as before.

In order to make the appearance of the beads more distinct, I shall use a cap with much coarser perforations, which, if carefully lighted, makes a flame of marvellous beauty.

The cap is now studded with an array of gems whose brilliancy would pale that of the brightest emerald ever polished by the art of man. Their colour, which is all on the surface, appears, from spectrum analysis, to be indicative of the combustion of carbonic oxide, and it fades on the slightest interruption of the supply of air at the base of the burner.

These experiments indicate that a great increase must have taken place in the amount of air drawn in by the gas-jet. This has already been confirmed by experiment, proving that a burner of this size will burn safely a mixture of gas containing 4·6 volumes of air out of a total of 6·5 which constitute the combining quantity.

I have here a gas furnace consisting of 12 burners, each 1 inch in diameter, fixed on a flat cast-iron box, which supplies them all with gas. It has been taken from below a steam-boiler in this city, where it raises steam to drive three printing machines at a cost of 3½d. per hour for gas.

The products of combustion, after passing upwards through the tubes of the boiler, are carried by a jacket down the outside, and escape by a flue at the base of the boiler, thus making the whole service available for heating. This arrangement also renders a damper unnecessary, as the speed of the draught is due to the difference of the temperature of the hot gas ascending in the tubes and those descending in the jacket. Since this furnace was used, the tubes have never required to be swept; a most satisfactory testimony to the completeness of the combustion. Previously, when another furnace was used which depended on the chimney draught, the whole heating surface had to be swept at regular intervals.

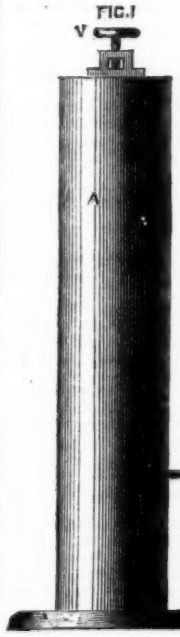
Among the useful applications of the heating burner, the gas stove is one of the most important. It is to be found wherever gas is used, and in spite of many real or imaginary objections, it is steadily making its way into public favour.

As the production of heat can be varied in a moment by the simple turning of a gas-cock, numerous attempts have been made to render the control of the apparatus automatic—that is to say, causing the heat of the flame in the stove to supply the power to regulate the gas. Many of these inventions have, doubtless, only lacked the publicity necessary to ensure the success of a worthy invention. The desirability of a good regulator is only too evident from the constant complaints that are made of the waste of gas through the carelessness or extravagance of persons who have the charge of gas stoves.

In constructing automatic regulators advantage is taken of the tendency of bodies to expand when heated, and to contract when cooled.

I am about to show you one which owes its movement to the expansion and contraction of air confined in a closed vessel. Air is remarkable for the small amount of heat that is requisite to change its volume. An increase of 1° Fahr. will expand 491 cubic feet of air into 492, and if it is not allowed to expand, by being confined, it will exert a pressure equal to a column of mercury 1-16th of an inch in height. A difference of a very few degrees, therefore, can easily accumulate sufficient force to close or open the gas orifice of a stove. The diagram here is intended to show how this may be put into practice, and such a regulator will work upon a change of 2° Fahr., adjusting, extinguishing, and relighting the burner as heat may be required, for weeks or months together.

FIG. 1



The mode of action is as follows:—A thin copper vessel (fig. 1) of a certain capacity contains the air which is to regulate the gas by its expansion. This vessel, marked A, is painted a dead black to render it the more susceptible to absorption, or radiation of heat, and it has on it a small valve, V, the purpose of which will be presently described.

A small pipe, B, leads from the expansion chamber to one end of the inverted syphon, C, containing mercury. The other end, D, of the syphon has within it a bell-mouthed tube, suspended over the mercury at about one-eighth of an inch from its surface.

The gas to be burnt enters the cup D, and passes over the surface of the mercury into the bell-mouthed tube, and thence to the burner in the direction of the arrows. In addition to this a tube, T, takes a supply of gas to a very small flame burning constantly beside the burner.

As the air is confined in the vessel A, the tube B, and the cup C, any increase of volume will depress the mercury in C, raise the level in D, and decrease the space below the bell-mouthed tube through which the gas escapes; and if the air continues to expand it will close it completely.

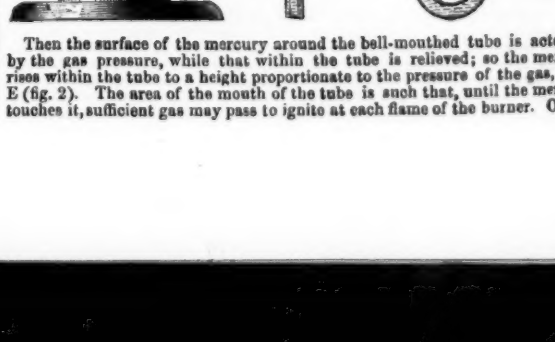


FIG. 2

Then the surface of the mercury around the bell-mouthed tube is acted on by the gas pressure, while that within the tube is relieved; so the mercury rises within the tube to a height proportionate to the pressure of the gas, as at E (fig. 2). The area of the mouth of the tube is such that, until the mercury touches it, sufficient gas may pass to ignite at each flame of the burner. Other-

wise, if some flames went out before the rest, there would be an escape of unburnt gas. When the air in the expansion chamber contracts, the mercury begins to leave the bell-tube, although it is still at a higher level within until its gravity overcomes the pressure of the gas when it falls clear of the tube, allowing a free rush of gas to ignite the burner immediately, which is effected by the aid of the constant flame.

All that is necessary, in order to set this regulator, is to open the valve on the expansion chamber, and light the burner. When the place to be heated is brought to the desired temperature, the valve, V, must be closed, and the enclosed air has a volume due to the temperature. Any deviation from it will affect the volume of the air and cause a corresponding adjustment of the gas. If the gas were turned slowly on and slowly off, there would be an escape and a nuisance each time it was lit and extinguished; but in this case the supply and cut-off are sudden, while the adjustment is gradual. With an apparatus of this kind a conservatory, for instance, may be heated with the greatest nicety. As sure as the thermometer falls below a given point, the gas will be turned on and lighted; and when the sun affords sufficient warmth, it will be extinguished until the temperature falls again. The expansion vessel should be in a mean position in the chamber to be heated, and the regulator should be as near the burner as possible.

In all cooking operations gas, when properly applied, has many advantages over coal as fuel, and these advantages are rapidly commanding recognition. Cooking is a chemical process, in which a certain amount of heat is made to act upon the food to be cooked. More heat or less heat than the required quantity results in bad cooking.

The heat of a coal fire is very irregular, and is liable to be affected by so many circumstances that much attention is necessary to keep it in the proper condition for delicate operations.

Moreover, the amount of heat produced by an ordinary kitchen fire is so great, in proportion to that requisite to do the necessary work, that the risk of burning and spoiling the food is much increased. The great merit of using gas is that you may obtain exactly the amount of heat you want, and apply it in the manner best calculated to effect the desired object. Besides all this, its cleanliness, and the facility with which it may be used at all times, are advantages which no other fuel can offer.

The heating of water and air baths is another purpose for which gas is admirably adapted, as it dispenses with a system of water-pipes which often give great trouble. The hot-air bath may be made ready for use in less than five minutes, and the temperature may be adjusted by the user to any point below 200° Fahr. It has also this advantage over the Turkish bath, that the bather is not obliged to breathe the hot air, which frequently produces faintness. The cost of gas for this bath is one-third of a penny. The hot-air bath is an apparatus of great value, both in health and sickness, and is so simple in its construction as to be within the means of any skilled workman. A paper, such as the present one, would not be complete if it did not inquire into the cost of producing heat from gas, as compared with that from coal.

I shall therefore appeal to the best known authorities for data on which to base the calculation. Dr. Letheby and Mr. F. J. Evans, after careful experiments in 1866, found that 13 cubic feet of coal gas, when burnt, would produce as much heat as 1 lb. of coal when completely consumed.

Dr. Neil Arnott, Mr. Edwards, the author of "Our Domestic Fireplace," and other authorities, agree in stating that, in the ordinary fireplace, of which the greatest number exist, only one-eighth of the total heat of the coal is utilized for heating purposes, the remaining seven-eighths go up the chimney. It follows, therefore, that 8 lbs. of coal would, under these circumstances, be required to produce heat equal to 13 cubic feet of gas, and their respective prices may be reckoned as follows:—

8 lbs. of coal at, say, 16s. per ton, will cost . . .	·765d.
13 cubic feet of gas at 3s. 4d. per 1000	·546
Difference	·219

The prices of coal heat and gas heat are, therefore, as 7 to 5 roughly, or, in other words, that amount of heat, which, if obtained from coal, would cost 7¼d., would, if obtained from gas, cost 5¼d. One-third of the gas heat might now be sacrificed in order to carry away the products of combustion, without raising the cost of the gas heat above that of the coal.

There are certainly many methods of using coal for heating purposes which are more economical than gas, but most of them are expensive to apply, and none of them possess the advantages of gas fuel. It should be an inducement to the public to know that the use of gas in the daytime is more likely than anything else to reduce the price of it, by giving more uniform occupation to the apparatus at the gas-works.

It must be borne in mind that it is on the proper combustion of gas that the fate of its application to household purposes depends. The prejudice against the substitution of gas for coal in cooking is not difficult to overcome; its relative economy for that purpose is established beyond denial, and its convenience is equally admitted. But the sickening smell from badly constructed burners is past all endurance, and nothing can reconcile people to it.

It is a great pity that the gas companies, who have brought the construction of the gas-meter to such perfection, should have allowed the manufacture of gas cooking and heating apparatus to fall into the hands of the most ignorant class of manufacturers, who are to blame for nearly all the bad repute attached to the system.

There are a few exceptions to this sweeping statement, but the numberless failures, particularly of burners constructed after Bunsen's principle, which must be present to the mind of every one who has had any experience of them, will bear out what I have said.

Gas companies are by degrees taking the matter in hand, because they find that it provides duty for their mains in the daytime, but the mischief is already done which it will take years to undo.

The increasing cost of household labour renders it highly probable that the same measure of success awaits the domestic application of gas as has already established the sewing-machine among our household gods, and had the gas apparatus been in equally competent hands, there is no doubt that it would long ere this have become one of our domestic institutions.

It is to be hoped that among the numberless schemes for gas manufacture which have recently been made public, we may soon be provided with a gas which shall be sufficiently cheap and plentiful, to be used not only for lighting and heating in private dwellings, but also for trade and manufacturing purposes in workshop and warehouse.

Gas is the perfection of fuel. It can be produced from materials unfit for burning in small fires or furnaces, it can be lighted in a moment, and burnt with the utmost regularity.

If we consider for a moment in what a very important relation the supply of light and heat stand to the daily requirements of our houses, it becomes evident that any really valuable improvement on our present method will contribute largely to the reduction of the cost of household labour, and help us on towards that Utopia of which we have lately heard so much and experienced so little.

The CHAIRMAN said he was glad to see so many gentlemen present who were competent and willing to express their ideas upon the important question which had been dealt with in the paper, and he was sure they would all agree that the remarks they had heard from the lecturer with regard to the combustion of gas were most important. He thought this was a question which was specially deserving the consideration of such a society as that which had been formed for the promotion of scientific industry, and on this account it was a great pleasure to him that Mr. Wallace had brought the matter before the members. Gas companies, as they had been told, had taken up the question of lighting, and had provided meters and numbers of other appliances and various improvements in this direction; but he thought it was very desirable that corporations and gas companies should also take up the question of heating by gas. For himself he was sanguine enough to believe that in a short time many of our large steam-engines would be worked through the medium of gas. He had witnessed many futile experiments with oil; but in heating boilers with gas, he was convinced that they had something which could be carried out with great success. The Bunsen burner was the foundation of all the improvements which had been carried out in this direction, and they were very much indebted to Mr. Wallace for the paper he had given them on the subject.

Mr. WALLACE, in answer to a question, explained the construction of his hot-air bath, heated by gas. The bath, he said, consisted of a small wooden frame, forming a square box. This was covered with calico on both sides, and there were two layers of paper between the calico, in order to divide the air spaces into three. On the top was a light quilt, with a hole for the bather's head to pass through, and the whole apparatus folded up just as a screen would do. The bath was so constructed that one person could arrange and use it, and the heat was regulated by a tap, which was under the command of the bather. The bath was so cheap that it came within the means of any one; and it possessed this advantage over the Turkish bath—that the bather was not compelled to breathe the hot air.

Mr. DREYFUS said he was well acquainted with the principle of the Bunsen burner, but Mr. Wallace had shown them one of the simplest regulators he had ever seen. He should have liked, however, if Mr. Wallace had given them more explanation as to the structure of the flame, as that was a matter which would have been very interesting to the audience present.

Mr. WALLACE said this reminded him that he had given too little attention to one of the most important parts of the subject. The difference between the flame he had shown them and the one ordinarily connected with the name of Bunsen was a matter of interest. It had been usually considered essential that the flame should have a hollow space within. The hollow space, however, was simply an indication that the gas had not sufficient air to consume it. If they gave a certain per centage of air to the gas before combustion, the flame was condensed, the hollow space disappeared, and they had a solid flame. The amount of air to be mixed varied with the diameter of the burner. The principal difficulty with large burners was that you must either burn less air and have a bad flame, or mix more and have an explosion; and, until the perforated cap he had shown them solved the difficulty, he had only been able to mix 1½ volume of air. Mr. Wallace then, by means of experiments, showed to the audience the difference between the hollow and solid flame.

Mr. BAILEY asked whether Mr. Wallace had found that any relative length or diameter of burner was the best.

Mr. WALLACE replied that it was impossible to formulate any rule for the construction of burners. If he was working with only one kind of gas, he might be able to supply figures to discover the size, and the shape, and the amount of gas to be burned at a given pressure; but the pressure, and the quality of the gas, and the purposes of the burner varied so much that it was impossible to give any particular instructions as to the size of a burner, and he did not think it could be reduced to a rule. Every one of the burners he had exhibited required a different proportion, and this could only be found out by experiment.

Mr. ROLFFS said there was one application of the Bunsen and this class of burner which was of the greatest importance to a place like Manchester, and this was the application of the burner to the heating of boilers for small steam-engines. In most of the cases where a small engine was required, there was a difficulty in having a boiler where very little room was available, and in having it so arranged that very little attention was required. They had in Manchester hundreds of boilers, supplying engines for packing purposes; but, if boilers with gas-burners for heating could be arranged on a small scale, the number of boilers in use would be three or four times as large. There was scarcely a trade that could not be better carried on with some kind of mechanical process, and if some one would pay attention to this matter, he was confident that a boiler of the description he had named would have a great future in Manchester. He thought this was a matter which Mr. Wallace had not given sufficient prominence to in his lecture.

Mr. WALLACE said this was a question which would require a whole evening to be dealt with properly. The construction of the boiler and the design of the engine would have to be thoroughly gone into; but he hoped to bring the subject before the Society on a future occasion, and he felt confident that in a town like Manchester it would soon be understood.

Mr. TRAIN said there was no doubt that the secret of a good burner was to prevent the light burning down; he had seen instances where the tubing had been melted, and there had been great risk of a fire. It had been obvious to every one that the solving of the problem of the use of gas in this way must depend upon the construction of a perfectly safe burner. Another point which struck him with regard to the use of gas for mechanical purposes was whether it could be best utilized through the agency of a gas-engine, or whether it would be most economical to transmit the heat through water. In the cases where the engine was wanted continuously through the day, it would be more advantageous to heat a boiler; but it struck him that a good gas-engine would have this advantage—that it could be used intermittently. He had on one occasion to use a boiler heated with gas, but the amount of waste was then very great; they were approaching a problem which would have to be solved.

Mr. HARROP said he had put gas-burners to a practical test during the last few months, in the direction of heating a green-house, and he found that a Bunsen burner and a properly-constructed boiler gave out better results than a coal fire, for he had always one temperature. For the last few days he had been experimenting with one of Mr. Wallace's burners, and taking it for all in all, he thought it was the best that had yet been brought out.

Mr. WALKER said it was over 12 months since he became acquainted with Mr. Wallace. At that time he was working a steam-engine with a gas-burner; but he had a great deal of trouble with it. It worked moderately well while it was new, but afterwards he had a great deal of soot, and he had considerable difficulty in getting rid of it. About that time he was introduced to Mr. Wallace, who put before him a burner which he had used with great advantage for a considerable time. During the last few months he had used the burners which had been shown to them that evening, and they had given very satisfactory results. They had been in use about six months, and the engine had worked seven hours a day, and his boiler was so arranged that when he was not using it he could put down the light. The cost for the seven hours a day during the last three months had been £7 0s. 5d., and for the previous three months, £7 7s. He believed that this apparatus was the first, and the only one in existence as large, which had been made by Mr. Wallace.

Mr. WALLACE, at the request of some of the members, having exhibited and explained his burner for gassing yarns,

Mr. STUBB said he had made some thousands of this class of burner. Mr. Wallace had seen all his experiments, and this burner, so far as it had gone, was the best that had yet been made. In this burner there was a lip hanging over, which prevented it becoming blocked up, as was the case with other burners; and several cotton-spinners could speak of the saving effected by this burner. There was a great advantage in crossing yarns over a longitudinal burner, and Mr. Wallace's burner was the nearest approach to perfection they had yet had. It would be a great success in the fine-yarn trade of Manchester, as it did not blacken the yarns. They were also going abroad to many places,

and there was not an instance in which it had been said that they had not done their work.

The CHAIRMAN said he was sorry the time had arrived when it was his duty to close the discussion. He had a pleasing duty to perform—to propose a vote of thanks to Mr. Wallace—and he would take the opportunity of offering a few remarks upon the general subject. It had been a very pleasant thing to have Mr. Wallace amongst them, showing them how the invention of Bunsen could be brought to such great perfection. The invention of Bunsen was the stepping-stone to making gas available for the various purposes of cooking, heating, boiling water, &c. During the last three months he had had the opportunity of seeing a large number of appliances for the application of gas to heating and other purposes, which were shown in the exhibition connected with that Society. The heating of a room at very small expense was rendered available by the use of a burner of this kind. There were also some very good gas stoves, in which the principle of this burner was introduced; he also found it in heating rollers and appliances of mangling, and in a variety of other burners for other purposes the principle was adopted. But he had not seen anything which approached Mr. Wallace's burners in adaptability to their several purposes. With regard to the application of this mode of heating to steam-boilers, he thought that if Mr. Wallace would go on in the direction he had done, he would provide something for forty or fifty horse power instead of one horse. He had been experimenting with some very small boilers that came from America for raising steam for small model engines; the construction of these boilers was rather peculiar, and there was a little element there that was worth considering. The boiler was an upright one with a number of tubes going right through. In each of these tubes a gas-burner was intended to be put, but there was one thing which the Americans had found out to be good. Passing up each of these tubes was a spiral piece of wire, and although some of the members of his firm were of opinion that this was intended to strengthen the tubes, he thought the purpose was to create a spiral current of hot air, and thus retain it in the tubes as long as possible. He thought this was a matter which Mr. Wallace might take into consideration in constructing his apparatus.

The vote of thanks having been unanimously agreed to,

Mr. WALLACE said he had been very much gratified by the manner in which his paper has been listened to. With regard to what the chairman had said, he thought the intention of the spiral wires in the tubes was exactly as Mr. Bellhouse had stated, but the object could be obtained in a more effectual manner by the method adopted in Mr. Walker's boiler, which he had described in his paper. He thought it was impossible to make any application of gas to heating purposes on a large scale without paying attention to appliances for retaining the heating properties of the gas. He had now only to return his thanks for the vote which had been just passed, and for the manner in which they had received his paper.

ON THE VALUE OF PETROLEUM AND COAL TAR IN THE MANUFACTURE OF COAL GAS.*

By Professor A. WAGNER.

As was stated in a previous article, refined petroleum was distilled after it had been freed from all components boiling below 150° Celsius. Its vapour was conducted through a red-hot porcelain tube, filled with broken pumice stone, thence through a condenser. Part of the vapours condensed, part of them were transformed into gas. When the temperature of the retort reached 288°, the experiment was stopped; one-third remained in the retort, one-third in the condenser, and one-third was transformed into gas. The petroleum used might therefore be considered as not the best quality of burning oil for lamps, on account of the large per centage of fractions boiling at too high a temperature. The results were as follows:—

	Specific Gravity.	Boiling Point.	Carbon per Cent.	Hydrogen per Cent.
Petroleum used . .	0·789	150 to + 360	85·7	14·3
Left in retort . .	0·830	288 to + 360	85·2	14·8
In condenser. . .	0·780	110 to — 190	83·0	17·0

The original combination of petroleum with 85·7 carbon is exactly in accordance with C_2H_4, that of heavy hydrocarbon gas, which also contains 85·7 per cent. carbon and 14·3 hydrogen.

The remainder in the retort, with much paraffin, is analogous to a mixture of petroleum and paraffin. The latter produced from raw petroleum has, according to Anderson, 85·15 per cent. carbon.

The combinations of the condensed part boiling from 110 to 150, with 83·3 per cent. of carbon, are similar to those of naphtha, of which the author found 83·3 per cent. carbon, and are nearest to the combination isolated by Schorlemmer from crude Pennsylvania petroleum "Pentan," C_5H_{12}, to which belongs an amount of carbon equal to 83·3 per cent.

As it was shown above, one-third of the petroleum was transformed into gas, and since the remainder in the retort, as well as the condensed part, passes less carbon than the original oil, it is also shown that the parts richest in carbon were transformed into gas. But by no means is this carbon all contained in the gas, which in that case must possess at least the amount of carbon contained in heavy hydrocarbon gas; but a considerable part is decomposed, producing a deposit of carbon.

According to Keim, gas produced in Hirzel's apparatus from petroleum refuse consisted of 17·4 per cent. heavy hydrocarbon gas, 58·3 per cent. light hydrocarbon gas, and 24·3 per cent. hydrogen. Now, as heavy hydrocarbon gas contains 85 per cent. carbon, and light hydrocarbon gas 75 per cent. carbon, the gas contains less carbon, and, therefore, more hydrogen than would belong to the petroleum refuse with 85 per cent. carbon.

According to Kolbe, Hirzel's petroleum gas consists mainly of acetylene, C_2H_2, with 92·3 per cent. carbon.

The author made an analysis of petroleum gas, with the following results:—

The gas was produced by conducting the vapours of petroleum through the wrought-iron tube (30 inches in length) described in a previous article, heated to a bright red for the entire length, and filled with pumice stone. The gas gave, with an ammoniacal solution of chloride of copper (Cu_2ClH_2N), at once the well-known reddish-brown deposit of acetylene copper; and with an ammoniacal solution of nitrate of silver, the greyish-white deposit of acetylene silver. The quantitative analysis gave 5 per cent. by volume acetylene, and 35·96 heavy hydrocarbon gas. The remaining 59 per cent. by volume consisted mainly of light hydrocarbon gas, and burned with a yellow flame of low luminosity.

Probably the petroleum is at a high temperature, at first transformed into heavy hydrocarbon gas, which has the same chemical combination, and is there partially split up, according to $C_2H_4 = CH_4 + C$, into light hydrocarbon gas, accompanied by a deposit of carbon, and part of this light gas, according to $(CH_4)_2 = C_2H_2 + H_6$, into acetylene and hydrogen.

If the petroleum had been transformed directly into heavy hydrocarbon gas, without undergoing decomposition and transformation, one gramme petroleum should have given 0·80 litre gas; but as the author received from 1·375 gramme petroleum 1·205 litre gas, and from 0·330 gramme petroleum 0·290 litre gas, the oil actually gave per gramme 0·876 litre gas (both experiments alike)—that is, a larger amount than if the oil had only furnished heavy gas.

If the petroleum or the heavy hydrocarbon gas formed therefrom had been entirely "split up," according to $C_2H_4 = CH_4 + C$, into light hydrocarbon and deposited carbon, one gramme petroleum should have furnished 0·792 litre light hydrocarbon, and 0·428 gramme deposited carbon. But it is well known that the decomposition of petroleum vapour in red-hot tubes is much more complicated; there is formed, besides deposited carbon and light hydrocarbon gas, acetylene, naphthaline, hydrogen, &c. Acetylene itself "splits up" at a high temperature into benzol, styrol, naphthaline, &c. If the splitting up of the petroleum or the heavy hydrocarbon gas formed therefrom would take place in the most simple form possible, according to $C_2H_4 = C_2H_2 + H_2$, into acetylene or hydrogen, the products of one gramme petroleum should be 0·798 litre acetylene gas and 0·797 litre hydrogen gas—*i.e.*, a total of 1·595 litre of gas. If the decomposition would take place according to the more probable equation—

$$(C_2H_4)_2 = 2(CH_4 + C) = C_2 + C_2H_2 + H_2,$$

the result would be a perfect decomposition, according to this equation, 0·398 litre acetylene gas and 1·194 litre hydrogen, equal 1·592 litre of gas, besides 0·428 grain deposited carbon.

This last equation explains why petroleum furnishes, at a high temperature, a much larger volume of gas than would be possible under simple splitting up into light and heavy hydrocarbon gas.

The most probable assumption, therefore, according to these experiments, is that the petroleum is split up at high temperatures, under deposition of carbon, into a mixture of acetylene gas, heavy and light hydrocarbon gas, and hydrogen. A simple transformation into acetylene and hydrogen is not probable, as the amount of gas in this case would be larger than that obtained by experiment.

The author further describes experiments made with naphtha, in relation to obtaining permanent gas. The naphtha employed was 0·676 sp. gr., and contained hydrocarbons boiling at 30° C., besides considerable quantities of such boiling up to 100°.

The elementary analysis showed 83·3 per cent of carbon, and 16·7 per cent. hydrogen; it contained, therefore, elements with less carbon than the refined petroleum, as well as the petroleum refuse. The combination agrees very closely with the Pentan, C_5H_{12}, by Schorlemmer, from Pennsylvania petroleum.

In order to test the quality for gas-making, the vapours were conducted through the previously described tube filled with pumice stone, heated to redness. After passing through a condenser cooled with snow, the gas was collected over water of 0° into a graduated glass cylinder, also surrounded by snow. After the gas had acquired the temperature of 0°, the volumes were read off as follows:—1·920 gramme naphtha—1·76 litre gas = 50 kilogrammes naphtha = 1619 cubic feet of gas. Naphtha, therefore, furnished a remarkably larger quantity of gas than refined petroleum, the gas being of excellent quality.

Since the naphtha may be obtained at a considerably lower price than the refined oil, it is very probable that the same may be used advantageously in gas-making; but, at the same time, the utmost care must be employed in handling and constructing the plant, to guard against the dangers of fire and explosion.

The author further speaks of the value of coal tar for producing permanent gas. As the Saarbruck coal gives in gas-making about 15 per cent. gas, and 5 per cent. tar (consisting of 2 to 10 per cent. light, and 15 to 30 per cent. heavy coal tar oils, and "Goudron"). There have been numerous experiments to utilize the same for the manufacture of gas.

Tar by itself not proving very promising, most experiments were directed to effect the change of volatile hydrocarbons to permanent gas by the addition of lime and steam. Amongst others, Vere and Crane, in 1823, injected steam into a retort where coal, tar, tar oils, &c., were being distilled or carbonized. In 1843, Malam used steam and tar vapours; in 1861, Prince distilled tar and steam over red-hot coal; in 1862, Cormack employed tar, petroleum, oil, &c., with steam; in 1867, Salmon, the same, besides numerous other trials without favourable results.

The results of experiments made by the author to ascertain the value of tar and tar oils for gas-making, under different conditions, are as follows:—

Materials Carbonized.	Gas received from 100 lbs. of Tar or Tar Oils.	Properties of the Gas.
Coal tar alone	143 cubic feet	It burned with low luminosity, like light hydrocarbon gas.
Light coal tar oil, 130° boiling point	131 "	Moderately luminous, like poor illuminating gas.
Heavy coal tar oil, above 160° boiling point	342 "	Bright, luminous.
Goudron (asphalte) free from components, boiling below 230°. .	229 "	Less luminous, like marsh-gas.
Coal tar and steam	301 "	Ditto ditto.
Coal tar, with slaked lime & steam	1519 "	Non-luminous.
Coal tar and slaked lime . . .	217 "	Blue, non-luminous.

This shows that none of these methods admit of the production of gas from tar; most advantageous is the heavy coal-tar oil, the least so is the light oil containing principally benzol, a phenomenon which may find its explanation in the fact that the benzol, being formed at high temperatures, is consequently stable at these temperatures. While the hydrocarbons of raw petroleum, with from 83 to 86 per cent. carbon, are easily transformed into permanent gas, those of the benzol class, with 92·3 per cent. carbon, do not possess those properties. But inversely can all constituents of illuminating gas, whether produced from coal, petroleum, or any other material—that is, light and heavy hydrocarbon gas, acetylene, and carbonic oxide—form benzol at high temperatures. The heavy hydrocarbon transforms under disengagement of carbon into light hydrocarbon, the latter under formation of hydrogen into acetylene. Carbonic oxide and light hydrocarbon form by heat acetylene and water and the acetylene at very high temperatures then forms benzol. There must, therefore, also be formed, during the formation of gas from petroleum, a certain quantity of benzol.

* Translated from "Dingler," vol. ccxvii., p. 64, by T. H. Muller.

GAS EXPLOSION AT BIRMINGHAM.—The *Daily Post* reports that about 12 o'clock on the night of the 27th ult., a serious explosion of gas occurred at the house of Grueber Heyman, clothier, 10, Tonk Street. He and his wife were sitting in a room on the ground floor, when they perceived a strong smell of gas, apparently proceeding from the first storey. Heyman took a lighted candle, and ascended to the sitting room; but he had scarcely entered the place before a quantity of escaped gas became ignited, and an explosion resulted. The window was blown out, two doors were torn from their hinges and smashed to pieces, and the furniture of the room was demolished. The window-blind was set on fire, and was blown across the road into St. Jude's Churchyard, where it continued burning for some time. Police-constable Freeman was attracted to the house by the report of the explosion, and he rendered great assistance to the alarmed inmates. Heyman was badly burned about the face, head, hands, and arms, and his shirt and waistcoat were partially consumed. The most remarkable thing was that all the finger-nails of one hand were blown off. Mrs. Heyman, who followed her husband into the room, sustained burns on her arms. Police-constable Freeman removed the injured man to the General Hospital, and it is alleged that on the road one of the men who was assisting him attempted to steal Heyman's watch. Freeman, however, prevented a disgraceful robbery being perpetrated, and the thief, upon finding himself detected, made his escape.

WASTE OF WATER AT GLASGOW.

REPORT BY MR. GALE, ENGINEER TO THE GLASGOW WATER COMMITTEE, ON TRIAL DISTRICT METERS AND THE OPERATIONS FOR REDUCING WASTE OF WATER.

At a Meeting of the Glasgow Water Committee on the 27th ult., the following report was submitted by Mr. Gale:—

The system adopted in these experimental districts to ascertain where waste of water existed was to sound the stop-cocks on the service-pipes in the streets at night, and then to examine only those houses or tenements during the day where water had been found passing. Upon the defective taps being found, the proprietors were called upon in the usual way to repair them.

The following table shows the districts selected, the population in each, the quantity of water used per head before any repairs were made, and the quantity used in the districts at present:—

District.	Population.	Gallons per Head per Day.			
		Before Repairs.		At Present.	
		Average.	Night Rate.	Average.	Night Rate.
Hamilton Drive . .	738	60	35	38	12½
Abercorn Street . .	2299	45	24½	20	6
Bain's Place . . .	1391	77½	59	50	4
Burnbank. . . .	667	65½	57	41	31
Averages . . .	5095	58·7	39·7	33·5	9·7

The meters used for the first three districts were of Siemens's patent, of a size to suit 3, 4, and 6 inch pipes respectively; and that used for the Burnbank district was Deacon's patent, for a 4 inch pipe. In the case of the Hamilton Drive district the quantity of water used was reduced in five weeks from 60 to 27½ gallons per head per day, and the quantity passing at night from 1 to 5 a.m. from 35 to 11 gallons per head for 24 hours.

Frequent night inspections have been made during the last nine months, but the fluctuations in the population during the summer prevent any reliable quantities being given. On the 3rd of November last a new census was taken, and the present consumption stated in the table is that due to this last population. In the Abercorn Street district the houses are of a much smaller class than in Hamilton Drive, the population are more stationary, and the taps will probably not be so carefully attended to, though they are very much less in number in proportion to the population. The quantity used here was reduced in eight weeks from 45 gallons per head per day to 25½, and the night flow from 24½ to 4 gallons per head in 24 hours; but in two months thereafter it rose to 37 gallons per head per day. In this district and in the Hamilton Drive district the pressure at night is about double what it is during the day, and the leakage at night is consequently much greater than during the day. In Bain's Place district the pressure is more uniform, and the reduction made in the water wasted has been maintained without much trouble for the last two months. There are eight consumers by meter in this district, using on an average 6·3 gallons per head per day, which reduces the present domestic consumption to 43·7 gallons. There are also 56 shops and other premises rated for trade supplies, yielding a revenue of £56 9s. 3d. per year, which at meter rates would be equal to 5·7 gallons per head per day, making the net domestic consumption 38 gallons per head; but this is still considerably more than is used in similar classes of property in other parts of the town.

The Deacon meter in the Burnbank district has only been recently fixed, and there has been only one night inspection. The repairs made, however, reduced the consumption to the quantities stated in the table; but in two days it rose to 51·7 gallons per head per day, occasioned by taps being left open to prevent freezing at night. The examination was suspended while the frost lasted, but it has been again resumed.

Taking the average of the four districts, the waste has been reduced 25 gallons per head, or 127,375 gallons per day, over the population operated upon; and if we assume that in six months the fittings will be in as bad repair as they were before, the total water saved would be 11½ million gallons, the value of which is £115, taking the actual cost of the water to the commissioners at 20s. per 100,000 gallons.

The cost of the operations has been as follows:—Inspector's wages, £38 4s. 2d.; cost of meters and fixing, £132 19s.; 10 per cent. on this sum for six months, £6 12s. 10d.; total, £44 17s. With a properly organized staff of night inspectors, the cost of future operations might be much reduced.

The defective fittings found consist of—1. Burst service-pipes; 2. Fittings conforming to rules but out of repair; 3. Fittings not conform to rules and out of repair. The commissioners pipes were found tight in all the four districts. The burst service-pipes averaged four to each district, and the detecting of waste from this cause is entirely due to the night inspection, as in none of the cases did the water rise to the surface or cause a deficiency of supply. The quantity of water lost was not determined, but it was no doubt large—in one case it appeared to be upwards of 5000 gallons a day.

The fittings which conform to the rules, but are found wasting water, have been, as a rule, properly repaired; but a great number are too light and of inferior workmanship, and I do not expect any improvement in this respect until all the fittings are tested and stamped by a proper officer of the commissioners before being used. No repair, which can be considered permanent, can be made upon those fittings which do not conform to the rules. Those found wasting water consist chiefly of water-closets supplied by various kinds of valves direct off the main without a cistern, and of common ground and Renison's cocks. At present these are not removed when found out of repair. If they are found wasting water twice within three months, I have to report the case to the Works Committee. In Liverpool, if any kind of single-valve water-closet is found wasting water twice in 12 months, it has to be replaced by a double-valve cistern; and the extent to which renewals of this kind, and the manner in which repairs are being carried on there, may be inferred from the circumstance that the number of lead pipes beat up by the inspectors, on account of water being found wasting, amounts on an average to 30 a day. I fear, before the same results can be obtained here that have been got in Liverpool, something like the Liverpool system of dealing with imperfect fittings will have to be adopted.

The results from these trial districts are encouraging, and I recommend you to extend the observations over a larger experimental area, and to use Deacon's meter for the purpose, for though it will, I believe, be more costly to maintain, and does not give such accurate results as some other meters, it is correct enough for this purpose, and it shows whether the tenements in which waste is taking place have been discovered by the night inspectors, which the other meters do not.

I would propose to take the districts supplied by the 12-inch main in Great Western Road, east from the Kelvin Bridge, containing about 18,300 persons. On account of all the distributing-pipes in the city being divided into short lengths for the purpose of affording a large supply of water in cases of fire, it would require at least 30 meters to take up the whole of this district, as the pipes are at present arranged, giving about 610 persons to each meter. It is desirable to reduce the number of meters as far as possible, and this can be done by joining the distributing-pipes, but considerable expense will have to be incurred to preserve the efficiency of the fire-cocks. This can be done by placing junction valves where the present branches leave the main—the valves to be closed only while meter observations are being taken. To have many of these, however, would complicate the working of the piping very much, and the best arrangement in some cases will be to lay short lengths of larger distributing-pipes to join the smaller to, and to put the meter upon a bye-pass. Neither should the districts be made too large, as it is desirable, for the purpose of obtaining a perfect diagram from the meter, that two men should get over a whole district in one night.

Keeping this in view, I have made a division of the Great Western Road district, and find that eleven meters will command the whole. The meters will cost about £40 each, including the fixing, or £440 in all, but I have not yet made an estimate of the cost of the works necessary for preserving the efficiency of the fire-cocks. The night inpection is much retarded by the brickwork round the service-cocks in the streets not being properly built, and by their not having proper street boxes, or by their not being brought up to the surface. The house proprietors probably ought to be called upon to put these into proper condition, though in Liverpool this is being done at the expense of the corporation.

The report of the engineer was approved, and further experiments by him were sanctioned by the committee.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

During the week just ended there has been very little business transacted, none of the manufacturing or iron works being in operation prior to Thursday. Even then hardly 10 per cent. made a start, so that, as a strict matter of fact, there has been nothing done in trade matters worth naming. In pig iron there have been a few sales at decidedly higher prices, quotations having become stiffer, owing to the marked upward tendency of the Scotch and Middlesbrough markets. Local No. 1 foundry iron is 66s. to 68s. for No. 1; 64s. to 65s. No. 2; and 62s. 6d. to 64s. for No. 3. The agents of the North Yorkshire producers now quote the subjoined list of prices:—No. 1 foundry, 55s.; No. 2 foundry, 53s.; No. 3 foundry, 51s. 6d.; No. 4 foundry, 50s.; No. 4 forge, grey, 50s.; No. 5 forge, mottled, 49s. 6d.; No. 6 forge, white, 48s. 6d.; refined metal, 70s.; Kentledge, 60s.; and cinder pig, 40s.; all per ton on net cash terms.

The brassfounders continue to be fairly busy, but there is not now so great a pressure of orders as has been experienced.

On Friday the great new Ogden reservoir of the Sheffield Water-Works Company was completed, in pursuance of the Act of Parliament. It is one of the finest works of its kind in the whole country.

The coal trade remains fairly good, but owing to the remarkably unseasonable weather the demand for household qualities is much below the average in all directions. Steam coal appears likely to be in better request in the early part of the new year.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Owing to the holidays, the usual weekly meetings of the iron trade have been very thinly attended, and although a few inquiries were made, apparently to test prices, the actual transactions were very few. Most of the mills and forges are still standing idle, and manufacturers do not seem anxious to resume operations, especially in the present unsettled aspect of the coal market. Prices are not quotably higher, but are very firm at late rates, which, however, are declared to be unremunerative, especially to the producers of the medium and common qualities of iron. The anticipated demand of the colliers for a further advance in the rate of wages has been the chief topic of conversation in all commercial circles during the week, and there appears to be little doubt that early notice will be given by the men, and should they succeed in obtaining their concession, a further rise in the price of coal will be inevitable.

The rise demanded is 1s. per day, and 9d. per day in the thick and thin coal districts respectively, but the miners would, no doubt, be contented with half the amount claimed, which would represent an advance of 2s. per ton in the price of coal. The effect of this upon the iron irade would be to advance prices to the extent of £1 per ton for finished iron, and seeing that South Staffordshire iron is already £3 per ton above the North of England standard, it is needless to point out the inevitable consequences of such a rise.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is very little to report this week in either the coal or iron trades of this district, the holidays apparently being a more important element than business. Most of the finished iron-works were closed on Friday evening for the new year holidays, and at the majority of the collieries work is practically stopped for five or six days.

Apart, however, from the usual interruption of business caused by the season of the year, the exceptional mildness of the weather has tended to produce a less active tone in the coal trade. There is not nearly the pressure for house coal, and furnace coal, burgy, and slack are only in very moderate request; but prices generally are well maintained. The pit quotations in the Wigan district remain as under:—Good Arley and King coal, 14s. per ton; Pemberton four-feet, 12s. to 12s. 6d.; common coal, 9s. to 10s.; burgy, 6s. to 6s. 6d.; and slack, 3s. to 4s. per ton.

For gas coal there is a continued steady inquiry, at late prices. Ordinary screened Wigan gas coal at the pit mouth can be bought at 10s. 6d. to 11s. per ton, but good screened Arley is quoted at 13s. 6d. to 14s. per ton.

For coke there is still little or no demand, and this class of fuel continues a complete drug in the market.

In the iron trade there is a nominal stiffness in prices, but, as there has been little or no buying during the past week, quotations are scarcely of any value. The indications, however, are that makers, when business is resumed, will be firm in their prices; and manufactured material is now participating to such an extent in the threatened upward movement in the raw that makers, in many cases, are refusing specifications which would have been readily accepted a few weeks back, at prices considerably lower than are now offered by consumers.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

As is usual during the Christmas holidays, there has been a little slackness in working the pits, but more work was done last week at the collieries than is generally the case in the holidays. The shipments of coals from the Tyne and Wear were very active, and, notwithstanding the recent large arrival of coasting sailing vessels, most of them have got cleared out, and there are not a great number to load. There are plenty of steamers in port, and some more sailing ships are anticipated, but the stocks of the merchants and gas-works on the east coast and in the British Channel seem to be now fully made up, and no more tonnage will be needed there for the present. The arbitration in the Northumberland and Durham coal districts is going on, and the award in the Northumberland coal-field will be made about the middle, and in the Durham coal-field in the latter part of January. Until it is understood through these awards upon what basis the wages of the men will be paid in the year we have entered

upon, it is anticipated that not many contracts for gas coals will be made; those that have been done were at something like 9s. per ton for best qualities. The leading collieries in the gas trade send great quantities of coals off with their own boats, and the shipments from the Tyne and Wear for the principal ports in the United Kingdom are pretty uniform. During last year the shipments of coal, notwithstanding the general complaints of bad times, were in excess of 1874; and, more singular still, the excess has been in Durham coals. This is a somewhat strange fact, as during the whole of the year the Durham collieries were represented to be in a most depressed condition. The prices of all kinds of coals are without change. Freights by steamers have been—London, 5s. 3d. to 5s. 6d.; Ostend, 6s.; Rochester, 5s. to 5s. 3d.; Havre, 7s. per ton; Hamburg, £9 per keel.

With the opening of the new year there seems a better feeling in the general trade of the North of England. Pig iron has been firmer in price, and in manufactured iron common bars have been selling at £7 5s. Merchants bars £9 per ton. There is more work on hand in the factories of Tyneside than there has been for some time past, and the chemical business has had a somewhat upward tendency. All this is in degree, of course; the improvement is extremely slight, but it is a movement from the torpidity that prevailed over trade so many months in 1875. The remarkably mild open weather which continues in the North of England is keeping men at work at outdoor employment, and the distress is not so great in the manufacturing villages as it was.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

In various parts of Scotland the question as to the liability of tenants or proprietors for the expense of lighting by gas in common stairs is exciting a considerable amount of attention. The latest case in point is one which was decided a few days ago before Sheriff Clark, in the Glasgow Small Debt Court. A house proprietor sued one of his tenants, a police-constable, for his proportion of the expense of lighting a common stair in a property belonging to the pursuer. The defence was a denial of liability, and that the house having been taken monthly, and the rent paid in that manner, the sum so paid covered the expense of lighting the stairhead gas. On the other hand, the pursuer averred that, unless there was an express stipulation to that effect, the defender was liable, in terms of the Glasgow Police Act, 1866, in which it is stated that the expense of lighting the common stairs "shall be recoverable by the proprietor from the occupiers in proportion to their respective rents, and be deemed to be a debt as, and in the same way as, rent." The sheriff gave effect to the contention of the pursuer, and decerned against the defender with costs.

On Saturday week, the 25th ult., a case of defrauding the gas company of Newburgh, Fifeshire, was brought up at the police court of that town. The charge was brought against William Summers, tinsmith and gas-fitter, and the plea of guilty was offered by the defender. His supply of gas was cut off some three or four years ago, in consequence of his gas account being in arrears. Strangely enough, the pipe had been cut inside the house, between the meter and the burners, and after the workmen left, Summers neatly joined the pipe again, burning no less than 15,000 cubic feet of gas from the time of the disjunction, as indicated by the company's meter. The sentence inflicted was only 30 days imprisonment. The provost, who was the presiding magistrate, believed the company were to blame for leaving the meter so as to form a temptation to Summers.

At the last meeting of the Town Council of Edinburgh, another report was laid on the table from Mr. J. Falconer King, the city analyst, in reference to the condition of the gas supplied within the city. On the 22nd of December, the Edinburgh Company's gas had an illuminating power of 31·50 standard candles, and that supplied by the Edinburgh and Leith Gaslight Company was only equal to 28·66 candles. Councillor Sloan facetiously remarked that the Edinburgh and Leith Company were improving backwards, and the Lord Provost replied that the council would require to stir them up. It is worthy of remark that the Edinburgh Company's gas is now about the best in Scotland in point of illuminating power, while the quality of the Edinburgh and Leith Company's is certainly much superior to the gas supplied in many towns in Scotland.

Another, but unofficial, application of the hydrostatic test was made on the Lintrathen line of water-pipes, on Monday, the 27th of December. The sluice-valve at Pitnappie was shut down at 10 a.m., and the gauge at Crathie indicated at 10.25 the hydrostatic pressure of 553 feet, at which point it stood steadily till 1.25 p.m., the pipes thus having been under the full pressure for three hours. The pressure was then gradually reduced till the ordinary working pressure was attained. According to the instructions of Mr. Stewart, C.E., the pipes were again tested last Thursday, between Pitnappie and Lintrathen, in presence of several of the Dundee Water Commissioners, their officials, and the contractors. In a few minutes after the sluice at Pitnappie had been shut down, a loud noise was heard, which indicated that another burst had taken place. The burst pipe was at a short distance from the Jordanstone railway station. Orders were at once given to remove the broken pipe, and put in a new one, so that the water might be let on again as speedily as possible. When examined after removal, the broken pipe appeared to be a sound casting, no special defect having been found. Is it not high time that the Dundee Water Commissioners contented themselves with the ordinary hydraulic pressure? Even the much-vaunted works of the Glasgow Water Commissioners are not perfect, as was amply proved a few days ago, the ordinary hydraulic pressure being quite sufficient to cause the bursting of one of the 48-inch syphon conduits near Strathblane, at a point where the line of piping crosses the turnpike road. The water tore up the earth and flowed with great impetuosity down the road. Fortunately, the water officer lives near the spot. He speedily got the valve shut down and stopped the flow.

At a special meeting of the Burgh Commissioners of Motherwell, held a few days ago, for the consideration of the tenders for pipes for the new water supply which was resolved upon some time ago, it was unanimously agreed that the tender of Messrs. R. Laidlaw and Sons, ironfounders and water engineers, Glasgow, should be accepted. The contract price was found to be £6484 13s. 9d., which, on account of the recent reduction in the price of iron, is considerably under the engineers first estimate.

The Water Commissioners of Perth have also just closed a contract for pipes which are required for a contemplated enlargement of the water supply in the new town. Tenders from three Glasgow firms were laid on the table at the meeting held to consider the subject. The offer of Messrs. Robert Maclaren and Co. was the lowest, and on the recommendation of the Water Committee it was unanimously agreed to.

The monthly meeting of the Greenock Water Trust was lately held at which it was reported that the superintendent of works had been instructed to proceed as early as possible with the construction of the addition to the main embankment at Loch Thorn, and the treasurer was authorized to borrow £5000 towards the cost of the proposed works.

Two schemes of water-supply are at present under the consideration of the Bathgate Burgh Commissioners, one estimated to cost £6081, and the other £8600.

After eight general meetings and nineteen committee meetings of the Campsie Parochial Board, as the local authority, have been held on the water supply question, it has again been resolved to delay bringing in an additional supply of water to Lennoxtown. According to Dr. Stevenson Macadam, of Edinburgh, the water at present in use varies from nearly 12 grains to fully 18 grains per gallon in respect of its contained saline matters, from 1·59 grain to 3·19 grains in respect of albuminized organic matter and nitrates, and from 5° to 10° of hardness.

In the early part of last week the pig iron market was firm, and as high as 65s. per ton was paid for warrants; but at the end of the week the market closed with sellers at 64s. 9d. fourteen days, and buyers at 64s 6d. prompt cash.

The coal market has been active since last report, but chiefly with the view of getting ships loaded so that they might set sail before the New Year's Day holidays commenced. Most of the pits have now closed for eight days.

REDUCTIONS IN THE PRICE OF GAS.—The Corporation of Birmingham have notified a reduction in the price of gas, in the parishes of Yardley and Northfield, to 4s. 3d. on consumptions under 10,000 cubic feet per quarter, and proportionately greater reductions on larger consumptions, up to 100,000 and upwards, at which the price will be 3s. 9d., all subject to 5 per cent. discount for payment within two months. At Ilkeston, reductions have been made on varying consumptions from 5s. 2d. to 4s. 7d., and from 4s. 7d. to 4s.

ROTHERHAM SEWAGE.—Mr. Bailey Denton, who had been requested to report on the subject, has presented a long and elaborate report to the town authorities. He recommends that land should be taken for the absorption and cleansing of 4 million gallons daily, and that for the present the quantity of land should be limited to 70 acres. He names three suitable sites, and gives approximate estimates of the cost of doing the work efficiently in several ways. These estimates range from £19,750 to £22,500. He assumes that the return from the land should pay the interest on its cost, and that the annual outlay for pumping and incidentals would amount to about £1900.

CARMARTHEN SEWERAGE WORKS.—The various contracts for these works have now been completed. In the spring of 1874 the corporation decided upon taking steps to complete the sewerage system of the town, and a loan of £5000 was obtained from Government for the purpose. About 2¾ miles of main sewers have since been constructed. The sewers are chiefly of brick, ranging from 1 foot 6 inches circular to 3 feet 9 inches by 2 feet 6 inches egg-shaped, and are designed to carry off combined rainfall and town sewage. The gradients being steep to provide against scour, the inverts are mostly built with blue Staffordshire bricks. The sewers are laid out in straight lines to facilitate inspection, with man-holes and lamp-holes in the usual manner. Ventilation is effected by frequent open shafts, having gratings at the street level, each man-hole and lamp-hole being also an open ventilator. The man-holes at the head of each sewer are provided with a flushing arrangement, consisting of a wrought-iron flushing-gate, working in a cast-iron frame, so arranged that the man-hole can be filled with water, which is then suddenly discharged down the sewer. The water for flushing is obtained from the town mains, excepting in cases where a natural supply is available. The engineer for the works was Mr. R. J. George, M. Inst. C.E.—*Engineering*.

GAS EXPLOSION IN BOSTON, U.S.A.—The Hamburg-American mail steamer *Wieland*, which arrived at Plymouth last Sunday night, brought New York papers to the 23rd of December. They contain accounts of a destructive explosion which took place in the States the previous evening. The explosion occurred in Boston, several persons being killed and a number of others injured. The large gas-main running under the Federal Street Bridge to South Boston, and thence along the water's edge under the pavement in Federal Street, exploded with a loud report, tearing up the pavement for a distance of 150 feet or more. The street at the time was thronged with people, and many were buried under the *débris*. A grain warehouse was badly shattered, and will have to be taken down. The foreman was instantly killed; some persons were blown into the water, and several dead bodies were recovered. Six or eight persons known to have been in the vicinity are still missing. As to the cause of the explosion, the supposition is that the recent cold weather caused the pipe to burst, and that the ground becoming impregnated with gas, ignition from some cause took place.

GAS FOR HEATING PURPOSES.—We confidently look forward to the time—and we hope it is not far distant—when, in all large cities, at least, a heating gas will take the place of solid fuel for culinary and general heating purposes. What the consumption for that use would be, were the price sufficiently low, can scarcely be calculated; but if the consumption of illuminating gas on the island of Manhattan alone may be roughly estimated at 15 million feet per day, the consumption of heating gas would, probably, amount to 100 million feet; and since it must be made on an enormous scale, at a very low cost, and sold with a narrow margin for profit, there is reason to hope that the efforts to solve the question of an economical heating gas will solve also the problem of cheap illuminating gas; for though the essential properties, and even the composition, of these two will differ greatly, yet any process that will enable us to make a heating gas, at, say, 20 cents per 1000 feet, can, probably, be adapted to the manufacture of a cheap illuminating gas. In the interests of metallurgy, of manufacturing, and of general needs of civilization, we welcome every step toward the attainment of this great desideratum; and it seems, indeed, that no more inviting field for the application of science, skill, and economy exists than that of gas-making. This art has stood almost stationary for nearly half a centuary, while every other branch of productive industry has made enormous progress; and if the signs of the times are not deceptive, the day is approaching when the demands of consumers will force gas-making out of the rut of conservatism into the path of progress that is characteristic of our time and people.—*American Engineering and Mining Journal*.

PROTECTION FROM FIRE.—The Metropolitan Water Act of 1871 authorized the Metropolitan Board of Works to provide hydrants in connexion with the water companies pipes for the supply of water in case of fire. The Honourable Society of the Inner Temple have taken the first step in this direction, and, acting on the advice of their surveyor, Mr. Arthur Cates, they have laid down throughout their extensive property a new series of water-mains, with a complete system of hydrants, from which every portion of their buildings can be effectually commanded—the object to be attained being to secure the power of effectually attacking any fire immediately on its outbreak, without waiting for the attendance of the fire brigade. Of course, a constant supply of water with a sufficient pressure is essential, and in this instance the mains are connected with those of the New River Company in Fleet Street and Whitefriars, and the arrangements have been made in concert with that company, who now give a constant supply under pressure. On the 21st ult. the works were tested with highly satisfactorily results, the hose being fixed to the hydrants or stand-posts by the society's own servants, powerful jets of water, which were thrown over the highest buildings being at once obtained, the result showing that in case of outbreak of fire it could be at once attacked by the officials resident upon the spot, and with such force of water as probable to ensure success. The mains and hydrants were fixed by Messrs. Beard, Dent, and Hellyer, Newcastle Street, Strand, and the benchers of the inn may be congratulated on having been the first to apply the wise provision of the Legislature, and thus furnishing means of protection from fire which should exist in every street of the metropolis.

FOLKESTONE GAS COMPANY.—The *South-Eastern Gazette* says:—"On Monday afternoon, Dec. 27, about 120 gentlemen accepted the invitation of the directors of the Folkestone Gas Company to luncheon in the new gasholder, now in course of erection. The holder is 83 feet in diameter and 46 feet high, and will hold 200,000 feet of gas, which is more than the three existing gasholders will contain. It is being built on the telescopic principle, and when completed will form a handsome as well as substantial erection, reflecting great credit on Mr. C. Chamberlain, of Walmer, and Messrs. J. and W. Horton, of Smethwick, near Birmingham. The engineers are the well-known firm of T. and C. Hawksley. The total cost will be about £10,000. Mr. T. Cobb, chairman of the directors, occupied the chair at the luncheon. Sir E. W. Watkin, M.P., was present,

and proposed, 'The Chairman and Directors of the Folkestone Gas Company,' with the names of Mr. R. Hart, their adviser, and Mr. W. Medhurst, secretary. Sir Edward remarked that they had assembled to do honour to a public institution of great practical value, to an excellent body of directors, and to an eminently qualified executive. He went on to notice the formation of the company in 1845, with a capital of £12,000, and traced its history to the present time, when it has a capital of £45,000, and is applying to Parliament for further powers to purchase additional property. The daily consumption of gas (Sir Edward said) was 80,000 feet in 1866, and it is now 300,000 feet. The worthy member concluded by saying that the water was a great blessing and the gas a necessity, and he felt assured all would welcome the toast and drink it with all the honours. Several other toasts followed, and the guests expressed their gratification at the kind hospitality of the company, and not less so at the excellent arrangements of the secretary, and the catering of Mr. W. Medhurst, of the King's Arms Hotel. The holder was brilliantly illuminated and tastefully decorated."

BIRMINGHAM CORPORATION GAS-WORKS.—The *Daily Post* of Friday last, says:—"The formal transfer of the Staffordshire Company's works to the corporation will be completed to-morrow. The Birmingham Company's works were transferred on the 1st of September, and the purchase completed by the payment of the sum agreed upon. The corporation also undertook to work the Birmingham and Staffordshire Company's undertaking, upon terms agreed upon, as from the 30th of June last, and the works have been conducted on this arrangement. The formal transfer, however, was reserved until the 1st of January, when the mayor and a deputation from the Gas Committee will meet a deputation from the directors of the company, and the transfer will take place, without ceremony. There will, however, be a substantial gratification for the shareholders, in the shape of the payments to be made by the corporation, and securities to be handed over, which may be stated as follows:—

Certificates of annuities representing the maximum dividend—*i.e.*, £56,415 per annum.			
In cash—reserve-fund, as at June 30, 1875	£39,609	11	8
One-half of profit in excess of dividends for last half year, as agreed	15,000	0	0
Amount of capital not bearing interest	10,906	0	0
Total	£65,515	11	8

Being nearly 10 per cent. of the entire capital, to be divided between the shareholders, and a sum, in cash, equal to the half years maximum dividend, £28,207 10s. We hear with satisfaction that the trading has been most satisfactory since the gas-works have been in the hands of the corporation—alike as regards the consumption of gas, the economy of manufacture and administration, and the profits yielded for the benefit of the ratepayers. So large, indeed, is the demand, that, in order to supply it, important additions will have to be made to the works; and the requisite authority will be asked for by the Gas Committee at the Town Council meeting on Tuesday next."

HULL CORPORATION WATER-WORKS.—At a meeting of the Water-Works Committee of the Hull Corporation, on the 24th ult., the sub-committee appointed to investigate the various accounts of this department made the following report, which was received and adopted:—"Your sub-committee have carefully investigated the various accounts of the water-works, and have considered the treasurer's accounts as audited and approved by the regular corporation auditors. In the treasurer's department they found the amounts of receipt and expenditure given by him to be correct, but in the apportionment of the amount under the several heads of current accounts and capital account, some slight errors in form, which occurred for want of sufficient information, have been corrected, and they believe that the treasurer's account is now quite correct, both in form and substance. Your committee have spent considerable time in examining in detail Mr. Brown's, the water-works clerk's, department, and they find the balance-sheet for the year ending Sept. 29, 1875, to be correct, and your committee have pleasure in stating that the accounts in this department have been kept with great care and accuracy, but they have nevertheless been able to offer several suggestions to be carried out in future, which they trust will still further simplify and improve the method of transacting the business of this department. Your committee have also carefully examined and checked accounts in the engineer's department, and they have pleasure in stating that the accounts have been carefully and accurately kept, and merit the approbation of the committee; but careful examination into detail has enabled your sub-committee to offer useful suggestions for still more exact detail and check in future. The first object of your sub-committee was to ascertain the actual position of the water-works affairs as regards the receipts and expenditure of the past year, and what the prospect was of at once, or at an early period, balancing those accounts without having recourse to increased water-rents. With this view they have carefully considered the printed statement of the treasurer's, the water-works clerk's, and the engineer's departments, and they have summarized and combined in one a balance-sheet, hoping it will show the actual result of this year's work, and give some idea of what is to be expected in the future. On examination of the treasurer's account it will be seen that as far as his returns are concerned there appears to be an excess of expenditure over income of £9403 17s. 7d. But it must be borne in mind that the treasurer's account is no actual balance-sheet of the real results of the operations of the year, for in addition to the above sum the account has to be debited with accounts outstanding, Sept. 29, 1875, £223 19s. 2d.; recoverable water-rents. Sept. 30, 1874, £261 11s. 7d.; value of stores on hand, Sept. 30, 1874, £6418 1s. 3d.; total excess of expenditure and liabilities, £16,309 9s. 7d. On the other hand there is the large sum of £6546 2s. 11d., which was outstanding at the end of last year, which the committee had paid and must be credited with, as also with recoverable water-rents due Sept. 29, 1875, £980; value of stores on hand, Sept. 29, 1875, £7626 10s. 9d.; total £15,152 15s. 10d.; thus showing the absolute deficiency in the year to be £1156 13s. 9d. But there has been included in the above expenditure the following amounts:—Opposing the Newington Water-Works Bill, £1414 11s. 2d.; extra expenditure incidental on change of engineer, £227 13s. 4d.; inquiry committee, £66 19s.; total, £1709 3s. 6d. These, though properly charged as "ordinary," are expenses not likely to occur again, and may fairly be considered as extraordinary expenditure; therefore, but for this extraordinary expenditure, the operations of the year would have shown a balance in its favour of £552 9s. 9d. Further the committee have put down extension of pipes (exclusive of renewals) to the value of £1498 19s. This sum they would have been justified in charging to capital account, but it has been charged to expenditure, and consequently, in considering the ability of the water-works to pay their way, should be credited to the works, and being so considered, would, without taking credit for the extraordinary expenditure, show an actual balance in favour of the works of £342 5s. 3d. This state of things must be satisfactory to the committee, and fully justify them in hoping that the period of deficiencies has terminated, and that without increased rates the receipts of the water-works will in future at least balance the expenditure."

Register of New Patents.

25.—STRINGFELLOW, H. W., Folkestone, "*Improvements in the manufacture of drain-pipes.*" Provisional protection only obtained. Dated Jan. 2, 1875.

To reduce the cost of drain-pipes, it is proposed to mould them in portland cement, with or without an admixture of sharp grit, according to their sectional capacity, and thus obtain pipes impermeable to moisture.

46.—BONNEFOND, A., Paris, "*An improved meter or apparatus for measuring water and other liquids.*" Provisional protection only obtained. Dated Jan. 5, 1875.

In this improved meter or apparatus the following features or conditions are combined:—1. As a moving power the employment of an Archimedean screw with the hollow body and several very inclined threads. 2. An air chamber disposed to preserve the registering or counting mechanism from contact with the water or other liquids, and to suppress all joints on the rod which transmits the motion from the screw to the registering mechanism; this air chamber serving as a reservoir to regulate the pressure. 3. A special arrangement of registering mechanism with discs, such arrangement being based on the successive driving of wheels having alternately one tooth and ten teeth.

50.—DEACON, G. F., Liverpool, "*Improvements in apparatus for measuring the flow of water in pipes.*" Patent dated Jan. 5, 1875.

This invention relates to improvements made with the object of reducing the wear and increasing the efficiency of inventions already patented by this inventor, and which have been already described and illustrated in this JOURNAL. It consists, first, in the use, in connexion with the former patented apparatus, of a guide or guides for the disc, ball, or other object, or some part rigidly connected therewith; and, second, in the interposition of an insulating material between the disc, ball, &c., and the wire used in the former patented apparatus.

55.—DICK, A., Cannon Street, London, "*An improved compressed air or gas spring, and stuffing-box to be used in connexion therewith.*" A communication. Patent dated Jan. 6, 1875.

According to this invention, compressed air or gas is forced into a reservoir, in the cover of which is an aperture, in which the stuffing-box is fixed. The latter consists of a hollow ring of hardened india-rubber, the central portion of which has an inverted conical or funnel-shaped section, a space being formed between the exterior of such portion and the vertical exterior of the ring. The lower edges of the inverted cone and of the vertical external portion of the ring are respectively supported by a metallic ring or collar, in which are apertures through which the condensed air or gas passes. A plunger passes through the stuffing-box for the reception of the weight or strain, the lower part thereof being capable of working up and down in the reservoir, and having a collar or guide at the extremity, with apertures for the air or gas to pass through. The air or gas passes upwards and exerts pressure upon the exterior of the conical portion of the stuffing-box, thereby pressing it against the plunger and enabling it to work in a perfectly air or gas tight manner.

66.—KIDD, J., Martin's Lane, London, "*Improvements in the manufacture of gas for lighting and heating purposes, and in the apparatus connected therewith.*" Partly a communication. Patent dated Jan. 6, 1875.

The novelty of this invention consists, first, in the manufacture of lighting or heating gases in carbon, then carburetting this gas with hydrocarbon vapour, after which the carburetted gas is passed through a red-hot retort; by this means the mixture is made a fixed incondensable gas of high illuminating power. The second part of the invention consists in a novel arrangement and method of setting the retorts. Two or three horizontal gas-retorts are connected together, one above another, with only one stand-pipe or gas outlet leading to the hydraulic main from the combined retorts. When using three retorts, the gas from the lower retort must pass over the coal placed in the two upper retorts, or the gas from the upper retort, before escaping, may be forced downwards over the coal in the lower retorts. All the retorts should be charged with coal, and operated in the ordinary way.

71.—ABEL, C. D., Southampton Buildings, Chancery Lane, London, "*Improvements in motor engines worked by gas or combustible vapour and air.*" A communication. Patent dated Jan. 8, 1875.

According to this invention a water-jacketted cylinder, open to the atmosphere at both ends, contains—firstly, a working piston connected by a piston-rod, crosshead, and connecting-rods to an engine shaft; and, secondly, two other pistons, one on each side of the said working piston. These latter pistons are loose in the cylinder, and operate in the following manner:—Assuming the working piston to be at the end of its back stroke, resting closely against the back loose piston, and with a space intervening between it and the front loose piston, into which space an explosive mixture of air and gas or petroleum vapour has been drawn from an inlet valve, then, on the ignition of the explosive charge, the front loose piston is propelled rapidly to the front end of the cylinder, where it is retained by an arrangement of expanding wedges, which wedge it tight in a conical enlargement at the ends of the cylinder.

A partial vacuum being thus produced in the cylinder, by the expansion and cooling of the products of combustion, the working piston and, with it, the back loose piston, is caused by atmospheric pressure to travel towards the front end of the cylinder.

The working piston carries a sliding rod, which, as it approaches the front loose piston, comes in contact therewith, and also with the back loose piston, and thus arrests the motion of the latter, while the working piston, in continuing its motion to the end of its stroke, causes a space to be formed between it and the back loose piston, into which a fresh charge of gas and air is drawn through a second supply valve. The charge being ignited, the motions of the several pistons are effected in the manner above described, but in the contrary order and direction, the front loose piston, which was before wedged tight, being again freed so as to return with the working piston by being pushed outwards by the latter, whereby the wedges in becoming free are contracted by springs.

The working piston in approaching the front loose piston expels the products of combustion from between them through a discharge valve in the cylinder, and buffers are provided at each end of the cylinder, against which the working piston presses the loose piston, so as to expel all the gas and ensure a close contact between them.

The supply of gas and air to the cylinder is effected by a conical valve at each end, having passages in its stem through which gas and air enter the valve-box when the valve is open. The ignition of the charge in the cylinder is effected by a disc on the valve-stem, which as the valve closes carries a portion of flame from a gas-jet into the valve chamber, at the same time cutting off the communication between the valve chamber and the gas-jet. The supply valves are opened at the proper times for the admission of gas and air by means of cams on the engine shaft, and are closed by the action of springs.

For working the engine by petroleum vapour instead of coal gas, the liquid petroleum is caused to flow in a small stream into a pipe in the water jacket of the cylinder, where it becomes vaporized by the heat of the water, and is then conducted to the supply valve. The air supply is in this case also caused to pass first through a pipe in the cylinder jacket to become heated. The power of the engine is regulated by means of a governor in such manner that when the speed of the engine is too great the supply of combustible gas is entirely cut off, and the engine performs its strokes without any explosion of gas and air until the speed is again reduced. This is effected by means of a valve, the stem of which is raised or lowered by the governor so as to bring a head upon the stem, either above a projection on the face of a bevel wheel on the engine shaft (in which case the valve is open), or below the projection, in which case an incline on the projection closes the valve. A flap valve is also provided in the supply-pipe, for preventing more than the requisite quantity of gas from entering the cylinder. The piston and piston-rod are cooled by the circulation of water therein, the water being made to enter from the water-jacket of the cylinder into a branch pipe on the front end of the piston-rod, the branch pipe having a small receptacle on its end which is made to open a valve in the water jacket when the piston-rod arrives at its end stroke.

94.—ROWLAND, E., Manchester, "*Improvements in and apparatus for compressing air, and for raising and forcing liquids by the air so compressed or by steam pressure, which improvements are partly applicable to measuring and indicating the quantity of liquid passing through the apparatus.*" Provisional protection only obtained. Dated Jan. 11, 1875.

The features of novelty in this invention consist of a peculiar construction of air-pump, having the inlet valve fitted in the hemispherical end of the piston, which is always surrounded by water or other liquid, in order to ensure that the cylinder shall be completely emptied of air at each and every stroke of the piston; and in the arrangement and construction of what is called a receiver, into which the liquid to be raised or forced gravitates, such receiver being fitted with inlet and outlet valves worked by a tumbler action, and with a float which, being connected to counting mechanism, so indicates the quantity passing through the receiver. The liquid is raised from the receiver by the pressure of air or by steam pressure.

96.—BOULTON, M. P. W., Tew Park, Oxford, "*Improvements in engines worked by hot gases, or by hot gases and steam; parts of which improvements are applicable for generating steam.*" Patent dated Jan. 11, 1875.

This invention relates to engines worked by hot gases, or by hot gases and steam; parts of the arrangements described being applicable for generating steam. A double-acting cylinder is fitted with a hollow piston having a tubular piston-rod, in which water is made to circulate. The piston has two packings, with a space between them open to the interior of the piston, so that, as the latter moves in the cylinder, the water contained in it comes in contact with the interior surface of the cylinder, keeping it cool. The cylinder may also be cooled by water in a jacket surrounding it. The steam generated in the jacket and piston is collected in a steam-chest, and employed to work in the same cylinder, or in another cylinder. Fuel and air are pumped into the cylinder and ignited therein, performing work by driving the piston and generating steam; or, for generatiug steam only, the fuel and air may be drawn into the cylinder, the piston being moved by the steam power, in which case several cylinders may be arranged in one line, with their pistons on one tubular rod. The products of combustion may be discharged from the cylinder through regenerators, through which, alternating therewith, the fuel and air may pass to the cylinder receiving heat.

101.—BOWERS and FYFE., "*Improvements in the method of, and in apparatus for, producing gas or gases for heating and for illuminating purposes.*" Patent dated Jan. 12, 1875.

This invention has for its object, in the first place, to produce gas suitable to be employed in puddling and heating furnaces, and in the furnaces of steam generators, and to be otherwise employed in cases wherein heating properties are more particularly required. In the manufacture of such gas, a retort is employed similar to the retort described in former letters patent, No. 2873, Sept. 1, 1873. In the former invention, sawdust or other substances, which were used to absorb alkaline solutions, were fed in at one end of a retort, and were moved along the heated floor of the retort by means of travelling scrapers, and were discharged at the other end of the said retort.

According to the present invention, the retort is fed with breeze, coal dust, culm or anthracite dust, cannel dust, small coal, or other substances capable of yielding inflammable gases, or with mixtures of such substances; and the floor of the retort is heated to a degree sufficient to effect the entire or partial distillation or discharge of the gas from the said substances during their progress from the feeding end to the delivery end of the retort. The gas as it is produced is conveyed to the furnace or furnaces in which it is to be consumed, as is usual. An important feature in the present invention is that the fine coal dust, which at present is of comparatively little value, is utilized.

When manufacturing illuminating gas, the gas produced, as before described, is subjected to heat of a degree sufficient to render it a permanent gas, which can be condensed, or cooled, and purified without losing its illuminating properties by the condensation or deposit of too large a proportion of the carbonizing properties; as, for example, we may cause the said gas to flow through a retort or pipe, or through retorts or pipes heated to the necessary extent. The gas may then be cooled and purified in the ordinary, or in a suitable, manner.

107.—WEATHERDON, B. F., Chancery Lane, London, "*An improved disinfecting fluid.*" A communication. Patent dated Jan. 12, 1875.

This invention consists of a disinfecting liquid, formed of sulphate of zinc, acetate of copper, phenic acid, and crystals of baryta.

108.—HIGGINSON, A., Liverpool, "*Improvements in motive-power engines and in pumps.*" Provisional protection only obtained. Dated Jan. 12, 1875.

This invention relates to motive-power engines, in which the crank is contained in the piston, such piston having a compound motion, and consists—1. In forming the piston with a tongue working in a well or chamber in the cylinder. 2. In providing the piston with contact pieces projecting from and across its periphery. 3. In supplying and cutting off steam by means of a slide-valve operated by the governor. 4. In admitting steam into the well to act on the tongue-piece before the end of the stroke.

112.—SELLARS, J. C., Birkenhead, "*Improvements in cement.*" Patent dated Jan. 12, 1875.

The kind or class of cement to which this invention relates is that employed for repairing, coating, lining, and setting gas-retorts, and other vessels and structures subjected to heat, and is now well known as Sellars's plastic cement. A good quality is produced by mixing silicious sand and silicate of soda or potash. An excellent quality is produced by mixing silicious sand, sulphate of baryta, and silicate of soda or potash.

135.—SCOTT, H. Y. D., Ealing, "*Improvements in the purification of coal gas.*" Patent dated Jan. 13, 1875.

The object of this invention is the purification of coal gas in such a manner as to obviate the disadvantages arising from the production of large quantities of fœtid and useless lime compounds which are difficult to dispose of. By this improved process the resulting substances may be utilized.

In carrying out this invention magnesia is employed as the chief absorbent of the carbonic acid arising from the distillation of the coal, so as in great part or wholly to do away with the use of lime. The magnesia is used either in dry or in wet purifiers, in the same way as lime is now employed, and it is also employed for decarbonating the ammonia which is sometimes used in freeing the gas from sulphur compounds in its subsequent treatment in scrubbers or other washing apparatus.

The magnesia used in this process may be obtained either by calcination in the ordinary manner or by precipitation from a salt of magnesia.

After passing gas through magnesia purifiers it may, if desired, be treated by any of the methods now practised in purifying gas. The carbonate of magnesia produced in this process is utilized in the extraction of carbonate of ammonia from gas liquor, according to a process for which letters patent, dated July 13, 1874, No. 2450, were granted to the present patentee, the double salt produced being employed for the manufacture of bicarbonate of ammonia or carbonate of ammonia, or after decomposing the carbonate with a mineral acid, such as sulphuric acid, for the production of a manure. The carbonate of magnesia being, however, mixed with some sulphide of magnesium, it is better to wash that substance from it (before using it for the extraction of carbonate of ammonia from ammoniacal liquids) by decomposing the sulphide with sulphate or phosphate of iron, which will lead to the formation of sulphate and phosphate of magnesia, both these salts being capable of utilization by well-known methods. The sulphide of iron, which also results from the decomposition, will by oxidation supply sulphate of iron, which may be used in the process just above mentioned. All these actions and reactions are well understood by chemists, and form no part of the present invention.

If it be required to employ sulphide of ammonium for the extraction of sulphur compounds, the employment of magnesia in the washing liquor will, by removing carbonic acid, constantly increase the proportion in it of sulphide of ammonia and free ammonia, and will enable the carbonate of ammonia which is absorbed by the carbonate of magnesia to be removed in a very portable form.

By submitting the carbonate of magnesia and ammonia thus produced to a red heat, the magnesia is recovered in a condition fit for re-use in the purifiers, and the carbonate of ammonia distilled off can be utilized in various well-known ways.

141.—CAVE, J. O'C., Weston-super-Mare, "*Improvements in the construction of apparatus capable of being employed as an automatic governor or steam-regulator, steam-gauge, safety-valve, and high-steam alarm, and also for regulating the flow or pressure of air, gas, water, and other fluids.*" Provisional protection only obtained. Dated Jan. 14, 1875.

The objects of this invention are effected by means of a piston which works through a cylindrical valve. The external end of the piston is loaded and adjusted to suit any desired pressure, the internal end of the same being attached to a sliding cover or door or disc. The variable pressure of the steam in the boiler regulates the pressure thereof on its way to the engine, and acts in a direct manner on the piston, the steam-way to the engine being thus opened or closed according to the varying pressure in the boiler. This invention is also applicable, as will be well understood by mechanists, to the other purposes mentioned in the title.

150.—RYDILL, G., Quality Court, Chancery Lane, London, "*Improvements in machinery and apparatus in the construction and working of vessels, tanks, reservoirs, and areas, and materials used for the purification of sewage and other polluted waters.*" Patent dated Jan. 14, 1875.

This invention of improvements is for the treatment of sewage and dye waters, as well as treating, purifying, and preventing the pollution of rivers and streams, so that the same may be used for domestic and manufacturing purposes by improved construction of vessels, tanks, reservoirs, areas, means and materials used to effect the same, and in improvements in machinery and apparatus for supplying water-closets with water, and in materials and method of purifying the same, which are also adapted for other purposes.

153.—NEWTON, H. E., Chancery Lane, London, "*Improvements applicable to burners for lighting purposes.*" A communication. Application dated Jan. 14, 1875. Patent void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.

This invention consists in adapting to burners for consuming gas, oil, liquid hydrocarbons, or other combustible liquid or fluid, accessories or appendages, whereby the air for supporting combustion may be highly heated before being supplied to the flame.

In carrying out the invention the illuminating flame is made to heat a volume of air supplied under pressure to a tube or tubular vessel, from which it issues from a suitable jet, and is made to impinge on the flame. By this means the intensity of the light is greatly increased, and the atoms of carbon are more effectually consumed.

As an example of the mode of carrying out this invention the burner is surmounted by a chimney composed of two tubes of some refractory material, and arranged concentrically one within the other, the space between them being filled with sand, asbestos, or other non-conducting material, which will prevent the loss of heat by radiation. Arranged centrally within this chimney is another tube or tubular chamber, which is supplied at the top end with compressed air, which escapes from a jet at the lower end, and impinges on the flame. At the lower end of this tube is a piece of lime, porcelain, or other refractory substance, against which the flame from the burner impinges, and by its high temperature raises this refractory substance to a white heat. As the heated gases from the flame pass up the chimney and surround the tubular air chamber the heat is communicated thereto, and the compressed air as it issues from the jet will be supplied to the flame in a highly heated state.

156.—JOHNSON, S. H., Stratford, "*Improvements in cocks or valves.*" Patent dated Jan. 14, 1875.

The specification describes constructing a draw-off cock or valve of a shell or casing with a side projection to be screwed or fixed to the pipe or passage from which fluid under pressure may have to be drawn off. Through opposite ends of the shell or casing is passed a tube, and where the tube passes out through the ends, tight joints are obtained by cup leathers or other packing. The tube can be moved endwise through the packings, and in it are ports or openings of such a form as not to cut the packing. When the tube is moved endwise so as to bring the ports within the chamber formed by the shell or casing, fluid passes through them and escapes at one end of the tube.

175.—VERA, P., Colombia, America, "*Improvements in gas or hot-air engines, heated by heat generated by chemical action igniting hydrogen and oxygen gases to form water.*" Patent dated Jan. 16, 1875.

This invention consists of a process and apparatus for generating heat and motion, by causing the explosion of a mixture of hydrogen and oxygen gases in the proportions for forming water, and utilizing the heat generated thereby to convert the water so formed into steam, also to heat air to a high temperature with the steam produced in order to serve as a motor like steam serves, and also utilizing the electricity generated by the oxygenation of the hydrogen for decomposing water to obtain hydrogen and oxygen gases to add to the supply of gases for the same machine.

184.—WALLER, G., Holland Street, Southwark, "*Improvements in apparatus used in the manufacture of gas.*" Patent dated Jan. 18, 1875.

This invention has for its object the construction of retort-lids and mouthpieces whereby they may be sealed, or the joint between them rendered gas-tight without the aid of ordinary luting, and consists in casting upon the mouthpiece, near its front end, a flange, with a dovetailed or other groove therein. The face or front end of the mouthpiece is cast so as to form a curved and throated flange, which partially covers the flange first mentioned. The dovetailed groove is filled with a ring cast in soft malleable metal. A lug or lugs are cast on each side of the mouthpiece, and to this lug or lugs is hinged the lid or door, corresponding lugs being cast upon it. The door is cast with a turned-up and V-shaped edge. To the lugs before mentioned is hinged also a cross-bar, which is received into a staple hinged to the mouthpiece on the opposite side to which the door is hinged, and furnished with a small screw and cross handle. When the door is closed, the V-shaped edge of the lid is brought into contact with the soft metal ring, and upon the staple being brought over the end of the cross-bar, and the screw turned, such a pressure is brought to bear upon the lid as will cause its edge to bed itself in the soft metal, and thus form a gas-tight joint.

A modification of the foregoing consists in casting a projection upon the flange of the mouthpiece, and a recess for the reception of soft metal in the edge of the lid, the effect when the lid is closed being similar.

A second modification consists in casting a projection upon the flange of the mouthpiece, which projection, together with the surface edge of the lid, is turned with a flat face.

Instead of the staple having a screw as before described, it may have inserted in the slot a roller, which is brought to bear upon the curved end of the cross-bar by means of a short handle attached to the staple or slotted piece.

192.—Taylor, G. N., South Kensington, "*Improvements in lamps for streets and other places.*" A communication. Provisional protection only obtained. Dated Jan. 18, 1875.

This improved lamp is made of a glass cylinder or inverted truncated cone dropping in a frame on the lamp-post, and secured by a flange on the bottom edge, taking into recesses made in the arms of which the lamp-frame is composed.

197.—Ross, O. C. D., Craven Street, Strand, "*Improvements in apparatus and means for utilising petroleum and other hydrocarbon liquids in lieu of coal or other fuel.*" Patent dated Jan. 19, 1875.

This invention mainly relates to a shallow vessel termed a "carburettor," constructed with several orifices, through one of which atmospheric air is to be drawn or driven, and through such one of the others as may be selected by the operator it will emerge more or less saturated with hydrocarbon vapour in a state in which it is inflammable. This carburettor should be so partitioned interiorly as to allow of the current of air passing over the surface of the liquid in a long and continuous current, and the channel to which the air is confined should be capable of regulation so as to admit more or less vapour. In lieu of atmospheric air, gases of an inferior quality are employed, such as poor coal gas, wood, or peat gas, decomposed steam, carbonic acid or oxide, more or less diluted with nitrogen or other vapours.

198.—Clark, J. L., Victoria Street, Westminster. "*Improvements in gas-regulators and in lighting railway carriages by gas.*" Provisional protection only obtained. Dated Jan. 19, 1875.

This specification describes pneumatic apparatus under the control of the guard or engine-driver to partially turn the gas off or turn it on to the burners; also an elastic regulator to prevent the flickering of the gas flames now caused by the oscillations of the reservoirs at the top of the carriages. Also preventing oscillations in the ordinary fluid regulators employed for regulating the pressure of gas as it passes to gas-burners, by admitting gas to the interior of the drum only by a contracted aperture, or by contracting the communication between the fluid in the interior of the drum and that on its exterior.

208.—Taunton, R. H., Wilton, Hayward, G., Acock's Green, and Knap, C., Gravelly Hill, "*Improvements in the manufacture of wrought-iron tubes.*" Patent dated Jan. 19, 1875.

The improvements relate to the machinery employed for forming the strip into a skelp previous to its being passed into the welding rolls, such operation being performed with great rapidity whilst the strip is under welding heat and passing from the furnace to the welding rolls.

209.—Johnson, J. C., Wednesbury, "*Certain improvements in forming strip iron into skelps, and welding the same into tubes, applicable for gas, steam, water, or other purposes; and in apparatus employed therefor.*" Patent dated Jan. 20, 1875.

The object and purpose of these improvements in the manufacture of welded iron tubes consist in the use of shaping rolls (with or without the additional use of a shaping die), and the welding of tubes by passing the skelps between the grooves of rolls placed one above the other, the top roll having the quality of being bodily elevated and returned to its work by a simple or compound lever, the said rolls being fitted and secured to a fixed or moveable stage or base.

210.— Dobat, H. J., Paris, "*Improvements in gas-burners, gas-regulators, or apparatus for lighting by gas.*" A communication. Provisional protection only obtained. Dated Jan. 20, 1875.

According to this invention caps or chambers formed with openings of gradually reduced or differential sectional areas are provided behind or below the burner end or nipple, so as to conduct the gas thereto from the pipe at a differential or controlled pressure, and thus prevent whistling or irregularity. The openings should be so contrived that the gas shall issue from each chamber in a direction at right angles to the direction of entry.

211.—Mather, J., Gateshead, "*Improvements in the means for producing gas from an admixture of atmospheric air with paraffin, petroleum, naphtha oil, or spirit containing a large amount of carbon, the said gas being adapted for lighting or heating purposes.*" Provisional protection only obtained. Dated Jan. 20, 1875.

Atmospheric air rushing through a jet produces a vacuum in a small chamber or generator, into which also opens a jet from a vertical tube descending into a cistern containing the carboniferous fluid. This vacuum causes the fluid to ascend the tube and to issue from the jet in a spray, which combines with the air rushing by. This combination is carried forward along a tube that passes through a furnace or oven, and is finally conveyed in a gaseous state to the hydraulic main, and thence to store tanks.

214.—Box, J., Westminster, Aubertin, E., Boblique, L., Leplay, H., Paris, "*Improvements in the disinfection of solid and liquid matters, such as night soil sewerage, either together or separately, gas and other foul waters.*" Patent dated Jan. 20, 1875.

The inventors employ a soluble alkaline phosphate and a soluble salt of magnesia, and oxide or other form of iron. They employ these agents in different combinations. They prefer phosphate of potash or ferruginous soda prepared by calcination in a reverberatory furnace, the phosphate of iron with the sulphate of soda and a soluble salt of magnesia, such as the chloruse of magnesium. The liquid to be disinfected is allowed to run through the raw products as they leave the reverberatory furnace; the sulphuretted hydrogen is deposited in the state of sulphate of iron. To the liquid thus deprived of the sulphuretted hydrogen soluble salt of magnesia is added; magnesian phosphate of ammonia is formed, and precipitates itself with the azoted organic matters. To disinfect solid matters the same products are used dry in powder. The inventors also employ phosphate of lime dissolved in hydrochloric acid, and oxide of iron also dissolved in chlorhydric acid.

APPLICATIONS FOR LETTERS PATENT.

4418.—Barlow, H. B., Manchester, "Improvements in the construction of filters." A communication. Dec. 21, 1875.

4420.—Ramsay, H. M., Twickenham, London, "Improvements in filters, and in the mode and means for effecting the filtration and purification of clear sewage, river, or other water or liquids." Dec. 21, 1875.

4427.—Sugg, W. T., Westminster, London, "Improvements in apparatus for maintaining the proper water level in station gas-meters." A communication. Dec. 21, 1875.

4428.—Sugg, W. T., Westminster, London, "Improvements in station and test gas-meters." Dec. 21, 1875.

4437.—Robins, W. B., Shepherd's Bush, London, "Improvements in lamps." Dec. 22, 1875.

4475.—Just, M. Z., Cornhill, and Downton, J., Limehouse, London, "Improvements in water-closets." Dec. 23, 1875.

4477.—Walker, W. T., Highgate, London, "Improvements in gas scrubbers, and in apparatus connected therewith." Dec. 23, 1875.

4490.—Jensen, P., Chancery Lane, London, "Improvements in the construction of fluid-meters." A communication. Dec. 24, 1875.

4500.—Souheur, A., Belgium, "Improvements in lamps." Dec. 24, 1875.

4521.—Wernekinck, E., Berlin, "A new or improved motor impelled by compressed air or other fluid or liquid." Dec. 29, 1875.

4526.—Clark, A. M., Chancery Lane, London, "An improved trap and grating for drain and sewer inlets." A communication. Dec. 29, 1875.

4533.—Lotz, W. F., Carter Lane, London, "Improvements in lamps." Dec. 30, 1875.

4546.—Brotherhood, P., Notting Hill, London, "Improvements in motor engines worked by steam or other fluid pressure." Dec. 30, 1875.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2346.—West, J., Maidstone, Kent, "Improvements in apparatus for discharging gas-retorts." June 28, 1875.

2819.—Lake, W. R., Southampton Buildings, London, "Improvements in gas-burners." A communication. Aug. 11, 1875.

2885.—Richards, J., Strand, London, "Improvements in mandrels for bending metal pipe." A communication. Aug. 16, 1875.

3317.—Imray, J., Southampton Buildings, London, "Improvements in gas-producing furnaces for boilers." A communication. Sept. 22, 1875.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3804.—Spencer, J. H., "An improved non-corroding water-closet apparatus, water-waste preventer, and overflow alarm." Dec. 16, 1872.

3821.—Target, J. L. F., "Improved means or apparatus for receiving human excreta, and for distributing deodorizing or disinfecting powder over the same." Dec. 17, 1872.

3822.—Kinsey, J., "Improvements in liquid-meters." Dec. 17, 1872.

3824.—Prince, A., "Improvements in hydro-oxygen gas-burners." Dec. 17, 1872.

3829.—Lackersteen, J. F., "Improvements in the manufacture of hydrogen gas." Dec. 17, 1872.

3852.—Henderson, A. C., "Improvements in apparatus for filtering and defecating water by radiation, in the mode of cleansing the said apparatus, and in its several applications." Dec. 19, 1872.

3871.—Penn, T., "Improvements in apparatus to be applied to water-closet and other cocks." Dec. 20, 1872.

3905.—Radford, J., "Improvements in steam, gas, water, or fluid taps." Dec. 24, 1872.

3913.—Badin, L. A., "Improvements in closets and apparatus for collecting and disinfecting fœcal matters, and converting the same into manure or human guano." Dec. 24, 1872.

Share List of Metropolitan Gas and Water Companies.

(*Corrected by Mr.* F. N. Golding, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
£	£	Gas Companies.	£ s. d	£ s. d	£
8000	26	Anglo-Romano . .	20 0 0	10 0 0	14—16
5000	20	Bahia (Limited) . .	20 0 0	..	10—11
1000	20	Do., preferenee .	20 0 0	..	25—27
1000	20	Do., do., redeem.	20 0 0	..	20—22
1500	20	Do., perpet. pref.	20 0 0	7 10 0	20—22
40000	5	Bombay (Limited) .	5 0 0	7 0 0	7¼ — 8
10000	5	Do., fourth issue.	4 0 0	7 0 0	1½-2 pm.
10000	20	British (Limited) .	20 0 0	10 0 0	34—36
7500	20	Cagliari (Limited).	20 0 0	5 0 0	14—16
5500004.	Sk.	*Commercial*	100 0 0	10 0 0	193—196
20000	20	Continental Union.	20 0 0	8 0 0	21-22xd.
20000	20	Do., new	12 10 0	8 0 0	par-¼pm
10000	20	Do., preference .	20 0 0	7 0 0	25—27
5000	10	*Crystal Palace Dis.*	10 0 0	10 0 0	17½—18
5000	10	Do., preference .	10 0 0	6 0 0	12 —12½
10000	7	Do., ordinary . .	10 0 0	7 0 0	12½—13
2500	10	Do., converted .	2 0 0	10 0 0	1½—2 pm.
2500	7	Do., converted .	2 0 0	7 0 0	1–1½ pm.
23406	10	European(Limited)	10 0 0	10 0 0	16—17
12000	10	Do., new shares.	7 10 0	10 0 0	4½–5½pm
35406	10	Do., new shares .	5 0 0	10 0 0	¾–4½pm
222656	10	*Gaslight & Coke* A.	10 0 0	10 0 0	19—20
10000	10	Do. B.	10 0 0	4 0 0	8—8½
703	10	Do. 5 per ct. pref. conv., 1st issue.	10 0 0	5 0 0	16½—17
627	10	Do. do., 2nd do. .	10 0 0	5 0 0	16½—17
30000	10	Do. do., 3rd do. .	10 0 0	5 0 0	16½—17
50000	10	Do. do., 4th do. .	4 0 0	5 0 0	16½—17
50000	10	Do. 5th do. .	2 0 0	..	1½-2 pm.
20000	10	Do. C 10 p.c. pref.	10 0 0	10 0 0	22½—23½
12000	25	Do. D do. do. .	25 0 0	10 0 0	55—57
6300	5	Georgetown(British Guiana)	5 0 0	5 0 0	..
5000	26	Hong Kong (Lim.)	10 8 0	10 0 0	15—16
1560000	108	*Imperial*	100 0 0	10 0 0	195—196
78000	12½	Do., new shares .	12 10 0	7 0 0	17½—18½
1300	100	Do., bonds . . .	£100	10 0 0	197—200
56000	50	*Imprl. Continental*	43 15 0	9 5 6	75—77
3000	40	*Independent* . . .	40 0 0	10 0 0	78—82
3000	10	Do.	10 0 0	5 0 0	9½—10¾
3000	20	Do.	20 0 0	7 10 0	30—32
4500	10	Do., D	3 0 0	10 0 0	3½—4
3783501.	Sk.	*London*	100 0 0	10 0 0	195—198
1500001.	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	127—130
14450	Sk.	Do., 2nd pref. .	100 0 0	6 0 0	
4350	Sk.	Do., 3rd pref. .	100 0 0	6 0 0	
7622	25	Do., A shares . .	12 10 0	6 0 0	
268051.	All	Do., Debent. stk.	100 0 0	5l. & 6l.	
15000	5	Malta & Med.(Lim.)	5 0 0	2 6 0	2–2½
6000	5	Do., preference .	5 0 0	7 10 0	5–5½
20000	5	Mauritius (Limited)	2 0 0	..	2–2½
25000	20	Monte Video (Lim.	20 0 0	8 0 0	19–21
8000	10	Nictheroy, Brzl.(L.)	10 0 0	..	
30000	5	Oriental (Calcutta).	5 0 0	9 10 0	8½—9
30000	5	Do., new shares .	2 10 0	9 10 0	2–2½ pm.
10000	5	Ottoman (Limited).	5 0 0	3 0 0	2–3
17500	16	Pará (Limited) . .	10 0 0	7 0 0	4–5
27000	20	*Phœniz*	20 0 0	10 0 0	39–41
3600001.	100	Do., new	55 0 0	7 10 0	81–83
1440001.	Sk.	Do., capitalized .	100 0 0	5 0 0	100–104
36000	20	Rio de Janeiro (L.)	20 0 0	10 0 0	29–31
7359	5	Singapore(Limited)	5 0 0	7 10 0	4½–5
2000	5	Do., preference .	5 0 0	7 10 0	5½–6
1500	32½	Shanghai	32 10 0	12 0 0	30–32
4000	50	*South Metropolitan*	50 0 0	10 0 0	100–103
4000	12½	Do.	12 10 0	10 0 0	25–26
20000	12½	Do., new shares .	5 0 0	10 0 0	9-10 pm.
15000	10	*Surrey Consumers*	10 0 0	10 0 0	19—20
10000	10	Do., new	8 0 0	10 0 0	8—9 pm.
9000	4	Unit. Gen'l., Limrk.	4 0.0	2 10 0	2—2¼
1500	10	*Wandsw. & Putney*	10 0 0	10 0 0	14—15
1500	10	Do.	10 0 0	7 10 0	11—12
2957	10	Do.	10 0 0	7 0 0	
993	10	Do.	3 0 0	7 0 0	
16000	5	*West Ham*	5 0 0	10 0 0	7¾—8
10000	5	Do., new shares .	2 10 0	10 0 0	3—4
		Water Companies.			
12000	100	Chelsea	100 0 0	6 0 0	132—134
1800000	100	East London . . .	100 0 0	6 0 0	132—134
8000	50	Grand Junction . .	50 0 0	7 0 0	82—84
5840	25	Do., ¼ shares . .	25 0 0	7 0 0	41—42
2160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	7 0 0	31—33
4396	100	Kent	100 0 0	6 10 0	143—145
5339	100	Lambeth	100 0 0	6 5 0	134—136
1161	100	Do.	20 0 0	6 5 0	
442	100	New River	100 0 0	8 0 0	170—180
4475	100	Do.	30 0 0	8 0 0	50—55
400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	98—100
3036	100	Southwrk. & Vauxh.	100 0 0	5 5 0	112—114
1296	100	Do., pref. stock .	100 0 0	5 0 0	103—105
	100	Do., D shares . . .	100 0 0	5 5 0	110—112
		Do.	..	4 10 0	
	100	Do., new ordinary .	..	4 10 0	
1600	100	Do., new ord. No. 1	40 0 0	4 10 0	
12172	61	West Middlesex . .	61 0 0	6l. p.sh.	133—135

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

FIG. 224.

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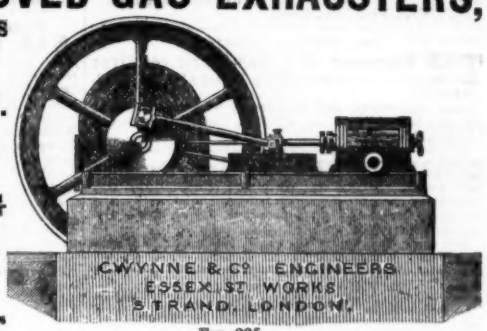

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,
CAN BE HAD ON APPLICATION TO
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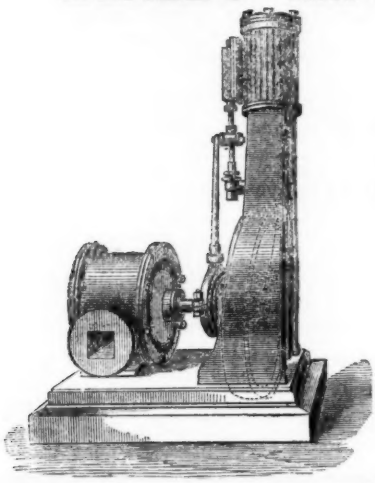

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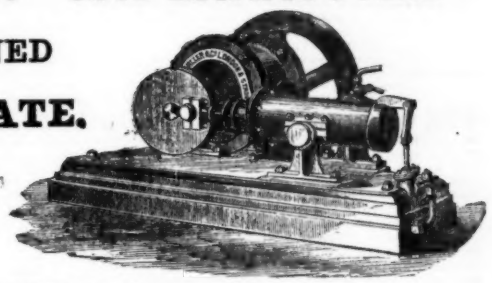

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MAKERS of ENGINES, BOILERS, and GAS MACHINERY.
TAR, LIQUOR, and SYPHON PUMPS. GAS-VALVES in stock, 2 to 30 inches.
SELF-ACTING BYE-PASS VALVES, with Lid and Relieving Lever.
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FOUNTAINBRIDGE WORKS, EDINBURGH,

MANUFACTURERS OF WET AND DRY GAS-METERS;

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ABOVE 30,000 OF WHICH ARE NOW IN USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

WORKING MANAGER Wanted, for a small work. The person appointed must be a good gas-fitter.

Apply, stating age, with testimonials, to T. W. R. WHITE, Gas-Works, SHERBORNE.

WANTED, a situation as Draughtsman. Thoroughly conversant with the construction of everything connected with the manufacture and distribution of gas, and the preparation of General and Detail Drawings and Specifications. Eight years experience. Excellent testimonials.

Address A. S., 4, Park Street, LINCOLN.

WANTED, by an experienced Man, a re-engagement as GENERAL MANAGER. Is well acquainted with every department of the works, keeping accounts, and carrying out of extensions and alterations. First-class testimonials and references.

Address No. 231, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Young Man, aged 20, who has been four years under Gas Engineers (part of the time in London), is anxious to get into a good sized provincial Gas-Work, where he could be usefully employed, and have opportunities of improvement. Salary would be of no importance at first, so long as the other conditions were complied with.

Address No. 232, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, the Management or Assistant Management of a Gas-Work. Five years practical experience in the manufacture and distribution of gas.

Address No. 214, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORPORATION GAS-WORKS, ABERAVON, SOUTH WALES.

WANTED, a thoroughly competent FOREMAN or Working Manager for the above works, who understands the manufacture and distribution of gas, retort-setting, and gas-fitting.

Apply, stating salary expected, and with copy of testimonials, to the TOWN-CLERK, Aberavon, SOUTH WALES, on or before Monday, Jan. 24, 1876.

BOROUGH OF LEEDS.

GAS MANAGER.

WANTED, by the Council of this Borough, a MANAGER to reside at and superintend, under the direction of the Gas Engineer, the New Wortley Works, in Leeds. Salary £150 per annum, with house, coals, and gas.

Applications, with testimonials, endorsed "Gas Manager," to be sent to my Office not later than Saturday, the 15th of January next.

By order,
CAPEL A. CURWOOD, Town-Clerk.

Leeds, Dec. 16, 1875.

WANTED, a Working Manager to take charge of Gas-Works making about 25,000 daily. None need apply who are not experienced in the working of clay retorts on the best principles.

Address, stating salary required, to No. 234, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

NEW EDITION, NOW READY,

ADVANTAGES OF GAS FOR

COOKING AND HEATING.

By MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their Gas Consumers.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

BOROUGH OF WIGAN.

THE Gas Committee of the Wigan Cor- poration are desirous of obtaining the services of a competent MANAGER of the Gas-Works belonging to the Wigan Corporation. His duties will include everything that pertains to the management and engineering of Gas-Works. Salary £300 per annum.

Applications, stating age, qualifications, and enclosing testimonials, to be sent in to the undersigned on or before Tuesday, the 11th day of January, 1876.

MARKELL WM. PEACH, Town-Clerk.

Town-Clerk's Office, Wigan, Dec. 23, 1875.

LEEDS CORPORATION GAS-WORKS.

TEN Pipe-Layers Wanted. Wages 30s. per week. None but competent men need apply.
H. WOODALL, Engineer.
Gas Offices, Boar Lane, Leeds.

ANALYTICAL CHEMIST.

THE Engineer of a Gas-Work requires the services of a thoroughly practical ANALYTICAL CHEMIST.
State age, salary, and experience, with references, to No. 233, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON, E.C.

STATION-METER for Sale, in good condition (Makers West and Gregson) in very ornamental case, fitted up with tell-tales, inlet, outlet, and bye-pass valves, and 12-in. connexions. Passes 25,000 cubic feet per hour. Now replaced with a larger one.
For price, &c., apply to JOHN W. WHITAKER, Manager, Gas-Works, WAKEFIELD.

TO ENGINEERS AND OTHERS.

THE Directors of the Rochester, Chat-ham, and Strood Gaslight Company OFFER a premium of £100 for the best design, with all necessary working drawings, for unloading coals from steam colliers and sailing vessels at their works at Rochester.
Lithographic plans, showing site, and particulars of apparatus required, may be had on application to the Secretary, at the Office of the Company, 56, High Street, Rochester.
Plans to be delivered on or before Feb. 29, 1876.
By order,
W. SYMS, Secretary.

TO CONTRACTORS AND OTHERS.

THE Directors of the Spennymoor and Tudhoe Gas Company, Limited, are prepared to receive TENDERS for the construction upon their premises of a Circular Brick TANK, 82 ft. diameter and 22 ft. deep.
Plans and specifications may be seen, and further particulars obtained, at the Offices of the Company, Spennymoor.
Tenders sealed, and endorsed "Tender for Gasholder-Tank," to be sent in not later than Monday, the 17th day of January, 1876, addressed to R. PRUDHOE, Esq., Secretary, Gas Company, SPENNYMOOR.
The tender lowest in price will not necessarily be accepted on that account.

BOROUGH OF LEEDS.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the supply of 500 D-shaped CLAY RETORTS. Dimensions 18 ft. by 15 ft. by 9 ft., to make 250 18 ft. throughs. Tenders to state price per foot lineal, delivered at the Gas-Works, Leeds. Two-thirds of the quantity to be delivered before the end of June next, and the remainder during the months of July and August next.
Tenders will be received, addressed to the Chairman of the Gas Committee, Town-Clerk's Office, Town-Hall, and endorsed "Tender for Clay Retorts," not later than Wednesday, the 19th inst.
The Committee do not bind themselves to accept the lowest or any tender, nor to take the whole quantity from any one firm.
By order,
C. A. CURWOOD, Town-Clerk.
Leeds, Jan. 1, 1876.

TO GASHOLDER MAKERS, IRONFOUNDERS, &c.

THE Gas-Works Committee of the Huddersfield Corporation are prepared to receive TENDERS for a Telescope GASHOLDER, 130 ft. diameter and 52 ft. in length, with the necessary columns and girders complete.
Plans and specifications may be seen by application at the Gas-Works.
Tenders to be addressed to me, and sent in not later than Monday, the 10th of January, 1876, endorsed "Tender for Gasholder."
The Committee do not bind themselves to accept the lowest or any tender.
By order of the Gas-Works Committee,
JOHN BURGESS, Engineer and Manager.
Gas Office, Leeds Road, Huddersfield, Dec. 23, 1875.

SOUTHPORT CORPORATION.—MAIN SEWERAGE WORKS.

TO CONTRACTORS.

THE Southport Corporation, acting as the Urban Sanitary Authority, hereby give notice that they are desirous of receiving TENDERS from competent persons willing to enter into a contract for the construction of the Main Outfall SEWER to the Crossens Channel, and several Main Branches, with the necessary screening chamber, side entrances, man-holes, ventilators, penstocks, flushing gates, and other works incidental to the above.
The plans, sections, and drawings may be seen at the Office of Mr. James Mansergh, the Engineer, 3, Westminster Chambers, Victoria Street, London, and at the Town-Hall, Southport, on and after Monday, the 10th day of January next, where also printed specifications and bills of quantities may be obtained on payment of two guineas.
Sealed tenders, endorsed "Main Sewerage Works, Contract No. 1," are to be delivered at my Office, on or before Saturday, the 7th day of February next.
The Corporation do not bind themselves to accept the lowest or any tender.
KEIGHLEY WALTON, Town-Clerk.
Town-Hall, Southport.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street WESTMINSTER.

THE BIRMINGHAM GASLIGHT AND COKE COMPANY, LIMITED.
Under which title is registered
THE BIRMINGHAM GASLIGHT AND COKE COMPANY,
Incorporated by the Birmingham Gas Act, 1855.

ALL Persons having any Claim or DEMAND upon the said Company, which has resolved to wind up its affairs voluntarily, pursuant to the Companies Act, 1862, and has appointed JAMES TERTIUS COLLINS, the Chairman, and THOMAS BULLOCK the younger, the Deputy-Chairman; together with Edward Bembridge, Edward Davenport, Frederick Everitt, Josiah Kempson, David Malins, and James Watson, the Directors, to be Liquidators of the said Company, are hereby required to SEND their full Christian and Surnames, and their Addresses, and the PARTICULARS of their Claims or Demands to the Liquidators of the said Company, at the Office of Mr. Joseph Slocombe, Public Accountant, No. 16, Bennett's Hill, Birmingham, on or before the 31st day of January, 1876, or in default thereof the Liquidators will proceed to wind up the said Company, and distribute the Assets thereof among the parties entitled thereto, having regard only to the Claims and Demands of which they the said Liquidators shall then have had notice.
JOHNSON, BARCLAY, AND JOHNSON,
36, Waterloo Street, Birmingham,
Solicitors to the Liquidators
Dated this 31st day of December, 1875.

NOTICE TO THE PUBLIC.
BRONNER'S IMPROVED SYSTEM IN GAS LIGHTING.

MESSRS. HENRY GREENE AND SON, 155, CANNON STREET, LONDON, sole consignees for Great Britain and Ireland of BRONNER'S IMPROVED SYSTEM IN GAS LIGHTING, beg to inform the public that JULIUS BRONNER, of Frankfort-on-Maine, in the Kingdom of Prussia, Manufacturer, has, of this date, 9th of November, 1875, obtained interdict before the Court of Session in Scotland, against R. M. Brechin and Company, Gas-Fitting Manufacturers, 46, Hanover Street, Edinburgh, and R. M. Brechin, the only known partner of the said firm, interdicting, prohibiting, and discharging the said R. M. Brechin and Company and R. M. Brechin from in any way advertising or offering for sale, or selling, or from in any way causing to be advertised, or offered for sale, or causing to be sold as "Brönner's Burners," any burners not manufactured by the said Julius Brönner, or from in any way endeavouring to induce the public to believe that the said R. M. Brechin and Company, or R. M. Brechin, sell or keep for sale "Brönner's Burners" manufactured by the said Julius Brönner, while such is not the case.
Further, the said Julius Brönner, on the 20th of April, 1875, in a suit in Chancery, 1874, B 365, instituted by him against a defendant who had been selling such Burners, obtained an injunction perpetually restraining the defendant, his agents, servants, and workmen, from in any way advertising or offering for sale, or selling, or from in any manner causing to be advertised or offered for sale or sold as "*Real Bronner*," or "Brönner," or "Broehner" Burners, any Burner not manufactured by or for the plaintiff, Julius Brönner, or by his agents.

TO GAS & WATER COMPANIES, & MUNICIPAL AUTHORITIES SUPPLYING WATER OR GAS.

CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875.
It is required, under a PENALTY OF FIVE POUNDS, that a PRINTED COPY of the 4th SECTION of the above Act shall be posted up at all Gas and Water Works in a conspicuous place, where the same may be conveniently read by the persons employed thereat.
Printed copies of the section, in large type, on broad sheets, may be had of WILLIAM B. KING, 11, Bolt Court, Fleet Street, LONDON. Price, per post, 2s. per dozen, or 10s. 6d. per 100.
The Act came into operation on Sept. 1, 1875, and extends to Scotland and Ireland.

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(JULY TO DECEMBER, 1875.)
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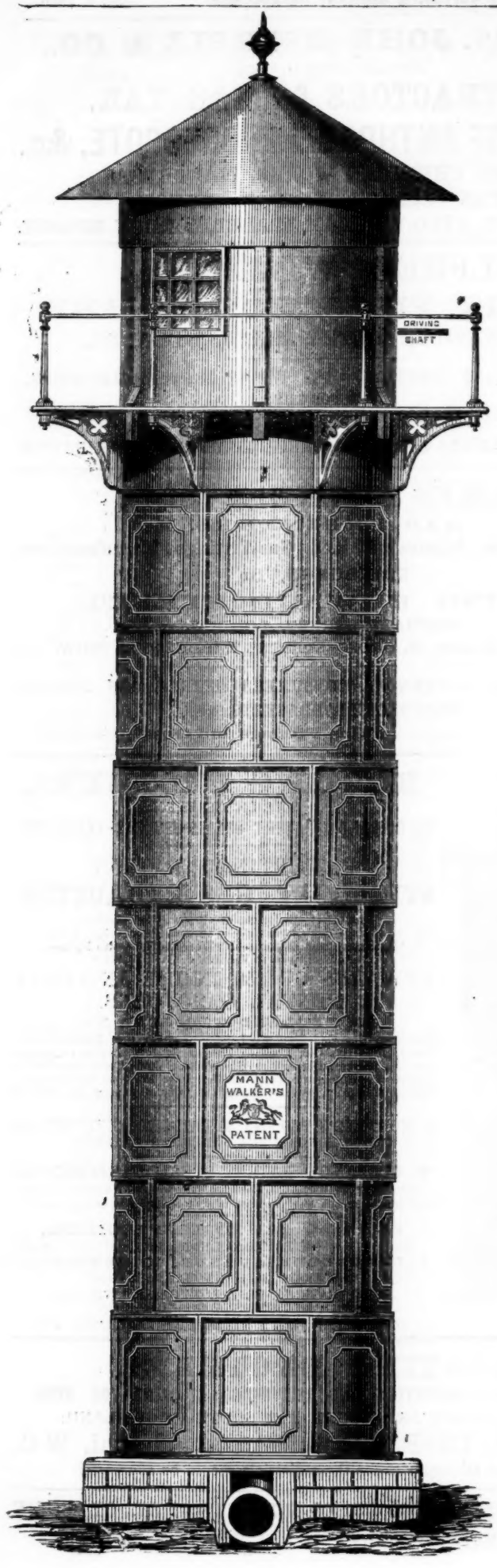

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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

The improvements made during the past three or four years in all the parts of the internal and external construction and machinery of these Scrubbers have rendered them perfect for their work of purification with all kinds of coal, and their cost is less than any other method of completely purifying gas from ammonia.

They contain their own motive power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, **nearly one hundred being in use,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

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Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

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WOOD GRIDS for Purifiers and Scrubbers.

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By recent improvements in the Hand Block-Press and Mould of size 18 in. by 9 in. by 9 in., a Labourer can now strike off 12 Stone Shell Blocks per hour; if on piece-work, 16 to 20 Blocks perfect, without crack or flaw. These 12 blocks form 1½ superficial yard of a wall 9 in. thick, and, being as smooth and perfect as the planed mould in which they are produced, they are equal, on every side, to finely-dressed stone, or to the best ordinary house plaster. The weight of material—namely, 4 to 1, dry Concrete—employed to make each super yard of the Blocks is as follows:—

For 4½-inch walls, it is 1 cwt. 0 qr. 13 lbs., 4 to 1 Concrete, which, with labour, at 5d. per hour = 1s. 0½d.

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For 14-inch walls, it is 1 cwt. 2 qrs. 10 lbs., 4 to 1 Concrete, which, with labour, at 5d. per hour = 1s. 4½d.

The Cement is estimated as 1 ton at 50s., and 4 tons of sand, mixed, at 4s. per ton.

To these figures must be added the cost of "carrying off" and "hardening"—say, 2d. per yard—and expense by waste and rent.

The Hand Press costs £55, and a Mould, of either of the sizes named, £12 10s., and appurtenances, £18. Moulds for other objects, in many cases, cost but a few shillings.

Any Mould within a diameter of 18 in. can be used to the same Press.

Having shown the competitive value of Stone Shell Blocks, as displacing ordinary house wall plaster with good Concrete, from the fact of their being moulded in a Shell Block form—that is, as large hollow bricks, of perfectly true surfaces—they have a further value of 1s. per yard if used for filling up with Concrete, made in the ordinary manner, as at present compounded by contractors. The Moulding Boards, as employed by them, in framing their Concrete Walls, cost them, on the average, for taking to the work, erecting, taking down, and returning to their workshops, 1s. per yard. Walls so constructed require to be "faced" on both sides. And there is this additional value, in their being of a large hollow brick form:—where stone, boulders, or burs can be obtained to fill in with, packed as a rubble-stone wall, a smaller amount of cementing material is necessary, either Concrete or strong Mortar.

Again, a 9-in. wall of a one-stone character is equal in stability to a common brick wall 14 inches in thickness. Besides these advantages, there is that of their neat appearance, and the fact that superior buildings can be put up with a less amount of skilled labour; and on that account, together with a facility in obtaining filling up materials, they are extremely well adapted for building in country places and the colonies.

The series of practical tests with the Stone Shell Blocks are well worth the cost of a visit of inspection—a practical handling of them being very much better than any written description.

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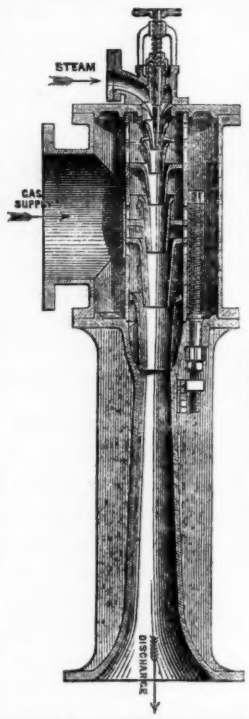

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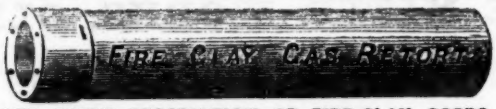

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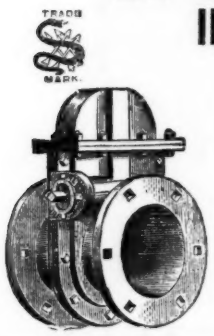

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These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

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The forms for this purpose are to illustrate the Paper on Distribution of Gas, read at the Edinburgh Meeting of the British Association of Gas Managers. By the use of the synopsis the whole of the out-door plant may at once be seen, with all matters pertaining to the same.

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SZERELMEY Liquid Enamel, for Iron-work exposed to the atmosphere, supersedes paint, dries in two hours, absolutely prevents rust, contains no oil, requires no mixing, is ready for use, is laid on like paint, covers new or old iron or wood, old paint, tar, or whitewash, is waterproof, gives a fine polished surface, and costs scarcely one-fourth as much as paint—namely, one halfpenny per square yard. Samples to any address for 12 stamps. Particulars free on application.

SZERELMEY Iron Paint has stood the test of 24 years experience. The gilding on the Victoria Tower of the Houses of Parliament was laid on over it upwards of 20 years ago, and is still in perfect condition.

SZERELMEY Stone Paint thoroughly waterproofs brick and other walls without giving them the appearance of having been painted.

COPIES of Reports on the Szerelmey compositions, by Sir Charles Barry, Sir R. J. Murchison, and Professor Faraday (printed by order of the House of Commons), with other information, may be had on application.

NONE of the Szerelmey compositions contain white or red lead, arsenic, or any other injurious ingredient. When in use and while drying they have a purifying effect on the atmosphere.

SZERELMEY Liquid Enamel.—The cost of the Enamel when laid on is about one halfpenny per square yard. We are now entering orders for execution at any time before the end of March, at £25 per ton, subject to a liberal discount for cash, particulars of which we will send, if asked. A ton measures about 125 gallons, and is ready for use.

SHIPPERS will receive liberal treat-ment at our hands. They will find that our Enamel Paste can be supplied for shipment at a price with which no ordinary paint can compete.

SZERELMEY Debentures.—Investors desirous of subscribing for the remainder are requested to intimate their intention as early as possible. The debentures will be dated Jan. 1, 1876; from that date interest at 8 per cent. per annum (for which coupons are attached) will be paid quarterly. No prospectus will be advertised, but full particulars will be sent in reply to any application addressed to N. C. SZERELMEY AND COMPANY, Limited, 24, City Bank Chambers, Threadneedle Street, LONDON, E.C.

THOMAS ALLAN & SONS,

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WORKS:

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Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.
„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

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PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
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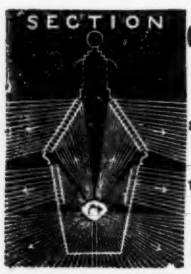

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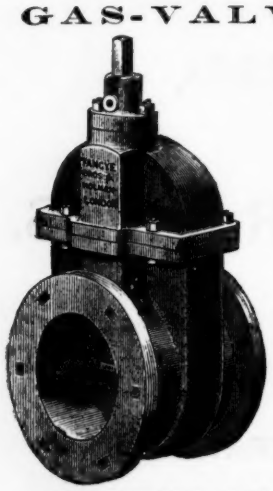

Inch.	s.	d.
3	25	0
4	36	0
5	40	0
6	54	0
7	63	0
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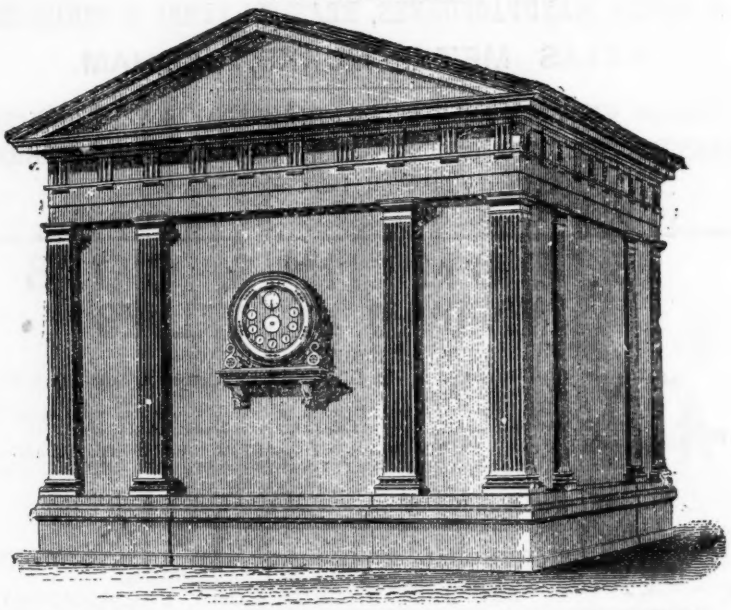

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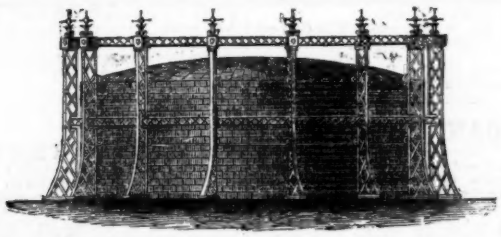

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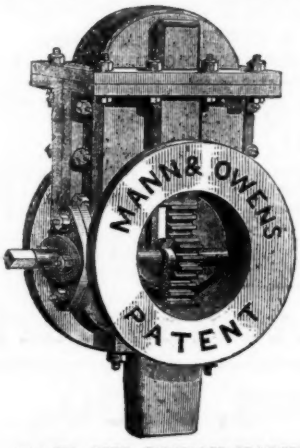
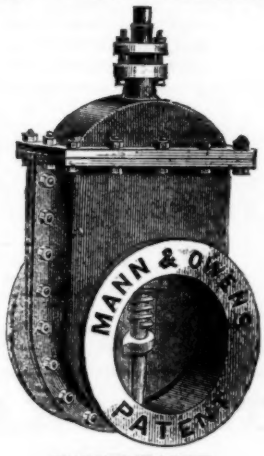


RACK AND PINION VALVE.



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The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

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SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;

GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;

And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.

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Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 12,100 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

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Yields 13,320 cubic feet of 32·5-candle gas per ton.
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Of the Abram Colliery Company, are worthy the attention of gas producers, showing a good yield of gas and a large residuum of excellent coke. When blended with one-seventh cannel, the gas is of specially high illuminating power.
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PRESENT PRICE:
5s. 6d. per Ton at Pit.
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Cubic Feet.	Illuminating Power.	Coke (sup. qual.).
10,000 ..	20 candles. ..	12 cwt.

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Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.
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COPPA COLLIERY, MOLD,
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This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.
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COTTERILL'S PATENT STEEL TUBE-DRILLS, for connecting services to water-mains, *under pressure*, without turning off the water. They drill and tap themselves, and are left in the mains. Made of all sizes, from ¾ to 2 inches and upwards. They cost less than the ordinary plan.
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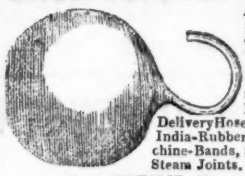

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.
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STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.
Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.
Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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(Successors to JOHN WILLIAM O'NEILL & CO.,)

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THE DERBYSHIRE

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GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

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This Company request attention to the very superior quality of their Cannel Coals.

1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.		Sample worked at Lochore
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure . .	13,095 cubic feet.	..	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	..	34·83
Value of 1 cubic foot of gas in grains of sperm	780	..	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	..	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	..	71 minutes.
Gravity of the gas (air = 1000)	596	..	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

	Capledrae Waverley.		Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	..	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	..	33·09
Value of 1 cubic foot of gas in grains of sperm	878	..	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	..	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	..	67 minutes.
Gravity of the gas (air = 1000)	677	..	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas. The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

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(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—THOS. G. BARLOW, C.E.

Over 90,000 in action.

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Branch Manufactories at DUBLIN and OLDHAM.

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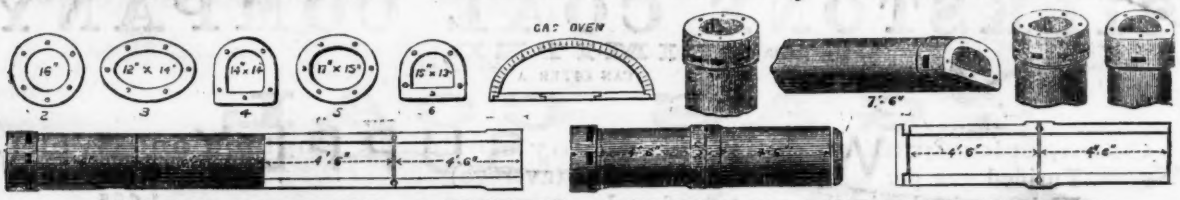

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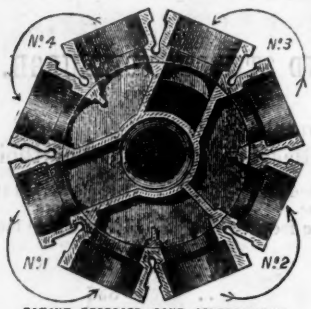

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Sectional Plan.

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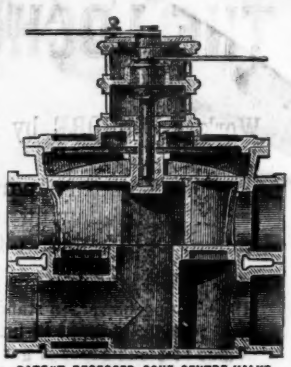
Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



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Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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